Factory
MANAGEMENT AND MAINTENANCE

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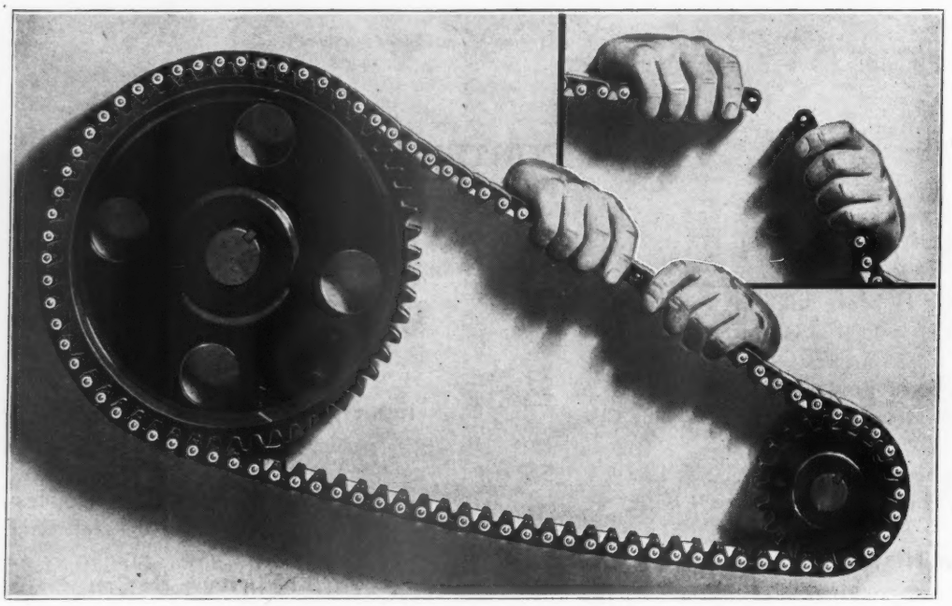
THE SILENT CHAIN DRIVE IS LOW IN FIRST COST



THE first cost of a silent chain drive, fully installed, is usually less than for flat or V-belt drive. And the most important cost, the total cost per year of efficient service, is always less — much less; as silent chain drives have operated 5, 10, 15, 20, 25 and even up to 33 years, with practically no attention or upkeep, except periodic replenishing of oil in the casing.

Advantages over belts or endless ropes are:

—equal or lower first cost in many instances.

—no dismantling of machine or removal of sheaves or pulleys to make repairs.

—no "machine down" time with consequent loss of production as when renewing "endless" belts and ropes.

—positive action assures full productive capacity of the machine . . . more pieces per hour.

—slipless action assures a better product . . . and removes the common cause of chatter marks, broken threads, etc.

—easy to install . . . just connect the ends of the chain.

—safety to employees . . . operates in oil-retaining casing.

Investigate the performance of the Link-Belt Silverstreak silent chain drive before deciding on your next purchase of driving equipment. Match its low first-cost with any drive on the market today. After you study the facts, there should be no indecision regarding which drive will prove the best value for your needs. Drives carried in stock — ½ to 60 h.p. — by distributors throughout the country. Larger Horse Powers supplied from the factory on short notice.

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Silent Chain Drives *P.I.V. and V.R.D. Variable Speed Transmissions* *Catalogs on Request*

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The Leading Manufacturer of Positive Power Transmitting Equipment

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SILVERSTREAK SILENT CHAIN DRIVE

Factory
MANAGEMENT AND MAINTENANCE

L. C. MORROW
Editor

Or Is It Insecurity?

NO DOUBT about it, there is an attitude of acquiescence toward the Social Security Act. This is not as it should be. It is commendable to desire security for workers, and at the same time it is consistent to condemn the Act in its present form.

There are many things wrong with it. We cannot hope to give both contention and proof in a short editorial, so shall confine ourselves to stating contentions. We suggest that you find proof in the Act itself.

▶By its taxing provisions, the Act forces a reduction in current purchasing power, because the amount of the tax will have to be added to prices or taken from wages (either the wages of workers or the wages of capital, or both).

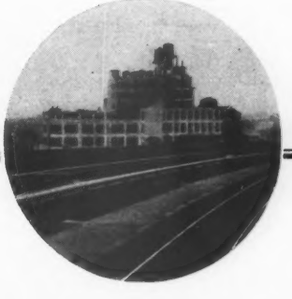
It sets up gross inequalities in tax loads by not taking into account the varying percentages of manufacturing costs represented by payrolls in different industries; by disregarding ability to pay (particularly by specific industries); and by ignoring the effect of geographical location upon size of payroll.

It places in the federal government powers of market and credit control that are nearly absolute.

It will divert to the federal treasury each year a large proportion of the savings that ordinarily go to finance industry and business.

It will build up by 1949 a fund of some 30 billions of dollars that will be a nucleus for political promising and an ever-present invitation for treasury tapping.

▶The law can be amended. But it will not be amended unless enough people take enough interest to get the job done. Congressmen still are susceptible to constituent influence. That influence ought to be used: **Before** the taxes for pensions become due. **Before** more of the states pass unemployment compensation laws. **Before** purchasing power becomes lowered by increased spread between wages and prices. **Before** industries have to suffer to prove that changes should be made.



International News Photo

W. C. Teagle, president, Standard Oil Company (N. J.)

SECURITY

We subscribe to the ideals of workers' security—not on a basis of paternalism, but in the belief that employee-employer cooperation is to the direct advantage of the business.

Every well-managed company sets aside reserves for emergencies and for the replacement of worn-out plant and equipment. It is more important that it provide reserves for unemployment and retirement of its workers.

In conformity with these ideals and beliefs we have undertaken, by means of our thrift plan, to cooperate with employees to the end that they may become owners of retirement and security funds.

W. C. TEAGLE

UNLESS the Social Security Act goes the way of a few other important pieces of New Deal legislation, industry will soon be getting set for old-age pensions. The 1 per cent tax on both employers and employees begins in 1937 and mounts gradually to 3 per cent by 1949.

For most industrial concerns all this would seem to offer no complication other than the rather serious one of who is going to pay the bill and how. Other companies, however, that have had perfectly good pension plans for years and years, are already finding themselves confronted with the formidable problem of what to do about those old plans. Shall they scrap them, merely fulfilling accrued obligations? Or shall they use old plans either in their present form or changed in the light of Federal legislation to supplement the Federal Act?

Those are points on which management still seems a bit befogged. Not so long ago we sat in on a spirited discussion as to what a concern might do under the law. Our only conclusion was that those particular plant operating men had read neither the Act nor any one of a number of excellent digests of it that have been made available these past months. Your guess on that point is as good as ours.

It is of course no thought of ours that a mere reading of this article will make it unnecessary for management to do a little homework and really digest the Social Security Act. However, it is our belief that management will welcome the experience of a concern that has had a pension plan, and has within the past few weeks charted a brand-new course of action.

The concern is Standard Oil Company (N.J.) It has had a pension plan for seventeen years. It may be classed as one of the pioneers in working with employees to improve their economic security. Some of the steps in that direction have been taken without cost to employees. Others have been on a cooperative basis. They include vacations with pay; accident, sickness, and death benefits; lay-off allowances; annuities; group life insurance; and a stock subscription plan.

Complications raised by payroll taxes under the Government pension plan, depreciation of the dollar, decline in interest rates on invested capital, and other factors made it no longer feasible to continue former annuity and stock acquisition plans. Not only that, but for seventeen years the company had managed its own reserves for annuities, and it

—This Is More Like It

was beginning to look like high time to place the responsibility for the payment of annuities in the hands of insurance companies where it was felt that it properly belonged.

Those in brief are the reasons that led to discontinuance of old pension provisions and the substitution of the present Employees' Thrift Plan.

The new plan permits employees to deposit from 3 to 13 per cent of their current earnings. On the first 3 per cent the company will match employee contributions dollar for dollar. On any amounts up to the next 10 per cent the company will deposit 50 cents for every employee dollar. The company may also make additional contributions from time to time.

Funds thus built up may be used for a variety of purposes. A certain minimum (equal to the amount of the company's contribution) must be allotted for the purchase of annuities on a group basis. Beyond that, employees may use their credits for additional group annuities, single-premium life or endowment insurance, company stock, or payment of dues in approved mutual hospital or medical associations.

Employee Writes His Own Ticket

The new plan is far more flexible than its predecessor. Instead of using a fixed formula for all, it provides opportunity for each employee to purchase within certain limits the amount of annuity protection he wishes to create for himself. As his needs and his social security taxes change, the employee may alter his rate of contribution or vary the amounts allocated to annuities, life or endowment insurance, company stock, etc. Also, after a certain period subscribers to the fund may withdraw a limited portion of their credits annually in the form of cash, stock, or insurance. There is a further provision for loans to employees, with either securities or credit balance in the fund used as collateral.

Since the ability of the company to pay the cost of such a program is so largely dependent upon the size of taxes imposed by the government, and since it is impossible to forecast the extent and nature of changes that may come with future legislation, it has been necessary to limit the cost of the whole program—thrift plan, benefit plan, lay-off and premature retirement expenses, and all government social security taxes —to 11 per cent of payroll. Should this figure be exceeded, company contributions would be scaled down to bring the amount within the 11 per cent limit.

This point is emphasized in the plan so that it will be clearly understood that a growth of payroll taxes to higher levels will not place dis-

(Continued on advertising page 54)

EMPLOYEES at the Standard Oil (N.J.) hydrogenation plant, Bayway, N. J., are among the 50,000 who may subscribe to the new Thrift Plan and thus supplement old-age provisions of the Social Security Act

720

INDUSTRIAL plants, as a rule, are notoriously wasteful of power in the different forms in which they use it. It is commonly conceded that anywhere from 25 to 50 per cent of it is wasted.

Study of the reasons for this surprising prodigality shows that individual carelessness and ignorance are responsible in large part. In the first classification comes the man who leaves lights on and motors running when not needed; who neglects to turn off water and steam; who thoughtlessly wastes compressed air.

To the second class belongs the man who does not know or realize that the cost of high-pressure steam is many times that of exhaust steam; that 100-lb. air cannot be made so cheaply as 20-lb. air; or that 20-lb. air is a much more valuable commodity than low-pressure or fan air. Also in this class fall the engineers, production heads, and foremen who, in the absence of means of determining the amounts of power *used* and the amounts that *should be used,* are unaware of the wastes that exist.

Four Principles

Much of this waste of power can be stopped by the application of four simple principles:

1. Educate every man to regard power in any form as a tool to be used intelligently and economically.
2. Determine the power used by departments, processes, or machines.
3. Set standards of power use for these items and compare actual use with these standards, always striving to use cheaper power where it can be done satisfactorily. Keep a continuous check on progress in preventing waste of power, and make the results, good or bad, known to every employee.
4. Remove or replace obsolete machinery.

The problem of education presents the greatest difficulty, but at the same time it results in the greatest direct saving. Educational campaigns must reach every man and woman employed. A single light

Ways To Save Power

left burning by a thoughtless employee is not of much importance, but the large number that hundreds of employees may leave burning will considerably increase power consumption.

It is almost a physical impossibility for any maintenance crew constantly to check and inspect every faucet and foot of pipe line throughout a huge plant, but if every employee reports the small things to his foreman and the foreman in turn reports them to the maintenance department, small wastes will be stopped much more quickly than when their detection is left to routine inspections.

To Reach Every Employee

The chart on the next page outlines the personnel and functions of an organization we set up. It is known as the Expense Reduction Committee. Power saving is just one phase of the work carried on by this committee, but it can easily be the basis of an entire campaign.

The organization of this committee may seem cumbersome at first glance. When the magnitude of the possible savings is considered, its size is not significant. Furthermore, it must be realized that any organization must be set up so that it can eventually reach every employee in the plant.

Only the activities of the Power Saving Committee are considered in this article, although savings in other items of expense reduction may be as great or greater than power savings. Such committees may deal with use and care of machinery and equipment, raw material savings, materials handling savings, or other subjects pertinent to some particular phase of the process.

The Power Saving Committee commenced activity with an inspection committee of which about half were trained men who could recognize power wastes; the other half were representative employees picked from different departments in which the inspections for power wastes were made. Each inspection was limited to the area that could be covered thoroughly in one hour. A report was submitted, listing each item of power waste noticed.

After the plant had been entirely covered by the first inspections, the reports were assembled and analyzed. A general meeting of all foremen, assistant foremen, committee members, and representative employees was called, and the purpose of the drive explained to them. Their attention was called to the most obvious of the power wastes noticed by the inspection committee, and their united cooperation was asked to help reduce these wastes.

The inspection committee makes an inspection every two weeks. Its report is reviewed by the Power Saving Committee. Individual items of waste in each department are called to the attention of the foreman or supervisor in charge of the section. Changes in operation or suggested changes to reduce power used, are referred to the engineering department or the department head for investigation. Since the start of the drive 720 recommendations for saving power have been turned in by the committee. After 19 months the power curve is still downward.

★

That many suggestions have actually come in since Corning Glass began its fight against waste of power, air, and water.

Savings per pound of packed product amount to 19, 46, and 49 per cent respectively. Multiply your own costs by them and figure out what it would mean to you in added profits.

Remember, all this happened in an exceedingly well-run plant that has never neglected its costs

★

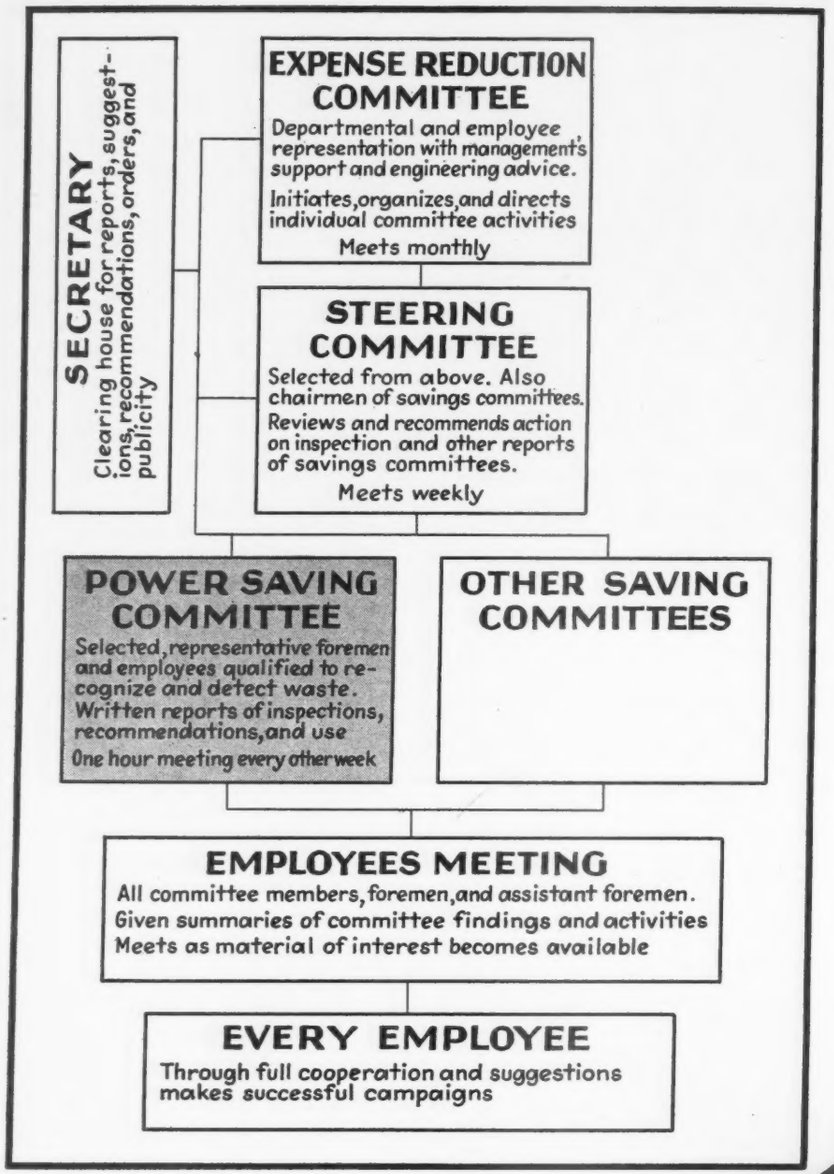
Standards Were Set

At the start it was difficult to estimate just how much power should be used. In order to set standards, all major users of power were metered. In many instances large daily variations were noticed at first, but as the foremen became accustomed to having monthly, in some cases daily, reports sent to them, the daily curves flattened out, which showed conclusively that the peaks as a rule indicated waste.

From the accumulated meter readings a standard weekly use of water, air, and electricity was set. Each week the per cent of standard is reported. In order to show the entire picture graphically in a single curve a composite curve giving true relative weights to different forms of power was designed. This was done by converting each item to the equivalent amount of fuel required to produce it, totaling the items in the standard and in the actual use, and determining the per cent of standard. The result is one curve which shows progress each week.

As a check on this curve the amount of electricity, air, and water used per pound of product is calculated each month. In the final analysis this is the truest picture of

ALFRED VAKSDAL
Plant Engineer
and
FREDERICK S. KRIGER
Assistant Plant Engineer
Corning Glass Works
Corning, N. Y.


SECRETARY
Clearing house for reports, suggestions, recommendations, orders, and publicity
EXPENSE REDUCTION COMMITTEE
Departmental and employee representation with management's support and engineering advice.
Initiates, organizes, and directs individual committee activities
Meets monthly
STEERING COMMITTEE
Selected from above. Also chairmen of savings committees.
Reviews and recommends action on inspection and other reports of savings committees.
Meets weekly
POWER SAVING COMMITTEE
Selected, representative foremen and employees qualified to recognize and detect waste.
Written reports of inspections, recommendations, and use
One hour meeting every other week
OTHER SAVING COMMITTEES
EMPLOYEES MEETING
All committee members, foremen, and assistant foremen.
Given summaries of committee findings and activities
Meets as material of interest becomes available
EVERY EMPLOYEE
Through full cooperation and suggestions makes successful campaigns

gains or losses, because if the quantity of power used per unit of packed product decreases, a saving must necessarily be made. The table shows the saving, in per cent, of electricity, compressed air, and water.

Results of our drive to reduce power waste present many interesting facts when analyzed. A breakdown of seventeen inspections which resulted in 350 recommendations or suggestions for power saving is given below. This is an average of about 20 suggestions per inspection:

Leaky water, air, gas, or steam valves and lines	49
Valves not turned off	48
Suggestions of a technical nature referred to the engineering department for consideration	19
Suggested changes, such as substitution of 20-lb. for 40-lb. air; fan air for compressed air; lower-pressure steam for high pressure	29
Improper uses of power	38
Motors left running idle	16
Lights burning needlessly (248 individual lights)	107
Miscellaneous — including temporary or frayed wires, light sockets pulled from drop cords, pipe lines improperly hung, or obsolete equipment	44
Total	350

Any capital investment in power plant equipment that would show

IF THE COMMITTEE SET-UP (left) looks cumbersome, remember that a power saving program, to get results like those below and across the page, must eventually reach every employee in the plant

SAVINGS IN POWER, AIR, AND WATER
Per pound of packed product

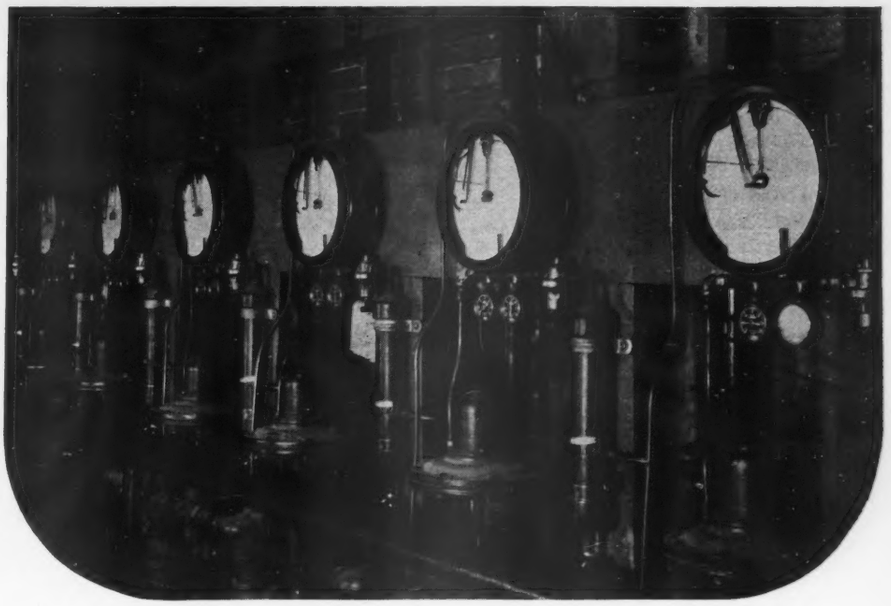
	4 Months Ave. Use Before Drive	*18 Months Ave. Use Since Drive*	*Saving*	*Per Cent Saving*
A. C. Power in Kw.-Hr.	0.697	0.566	0.131	18.8
Compressed Air in Cu.Ft. of Free Air	167.0	89.3	77.7	46.5
Water in Gallons	33.4	17.0	16.4	49.1

SAVINGS per pound of packed product (left) present the truest picture of results. Directly above, a brand-new Corning sauce-pan that withstands direct flame, can be used on top of the stove

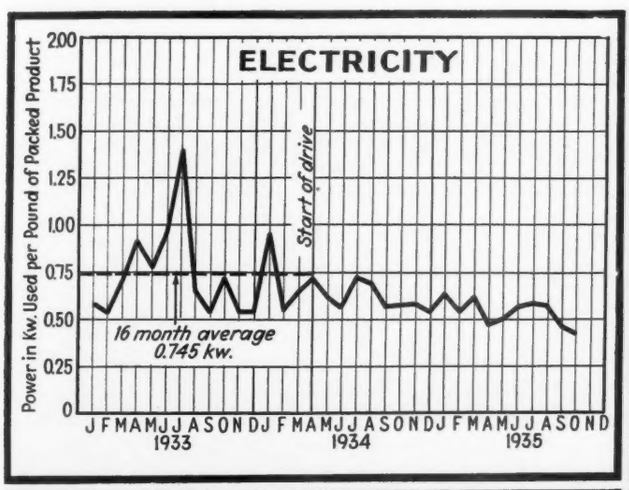
such savings as are reported here would immediately be investigated and considered. In many instances where the power plant is carrying about the maximum load, such savings in power, before business increases greatly, would save a large capital investment in new equipment. Savings in the use of power can frequently be made merely by education of employees; in other instances, changes in equipment or methods are necessary. It will often be found that removal of obsolete equipment will not only save power, but the investment in power-using instead of power-producing equipment will also result in increased production or improved product.

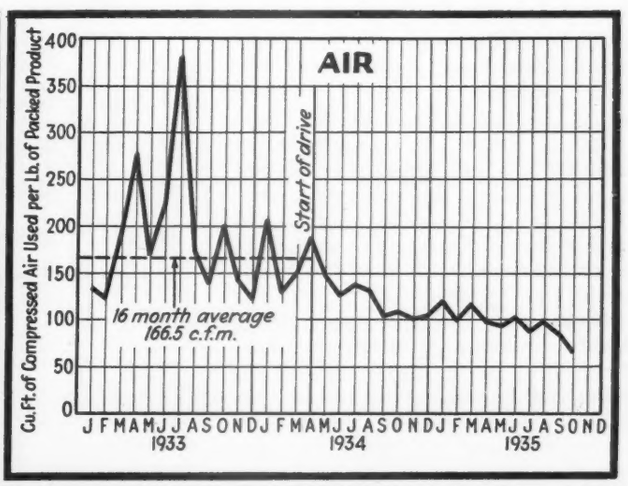
A power saving campaign cannot be spasmodic. It is keeping everlastingly at it that produces results. Personnel changes; new employees must be taught how to conserve power; old employees grow careless; equipment that is new today quickly becomes obsolete.

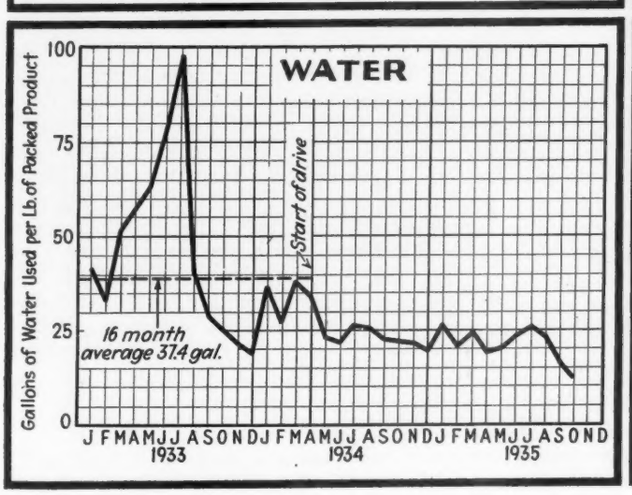
Power wastes can usually be found in abundance, and if each employee does his bit toward stopping them each day, the sum total at the end of the year will be astonishing.

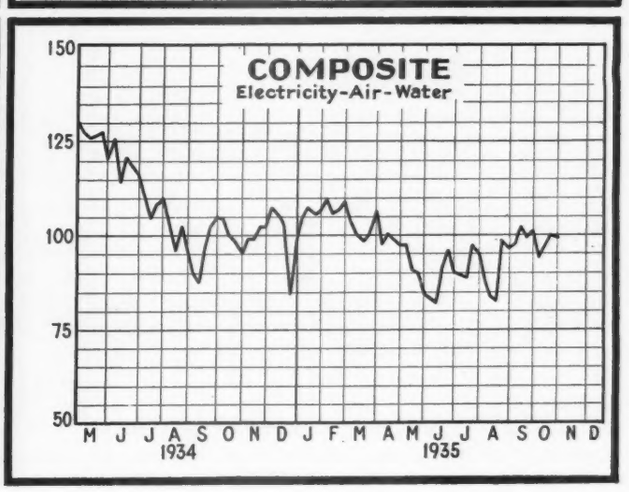


Meet some of the meters that enabled Corning Glass to set standards against which to measure actual use of electricity, air, and water. Unless a plant has the right instruments, any attempt to stop power wastes will flop



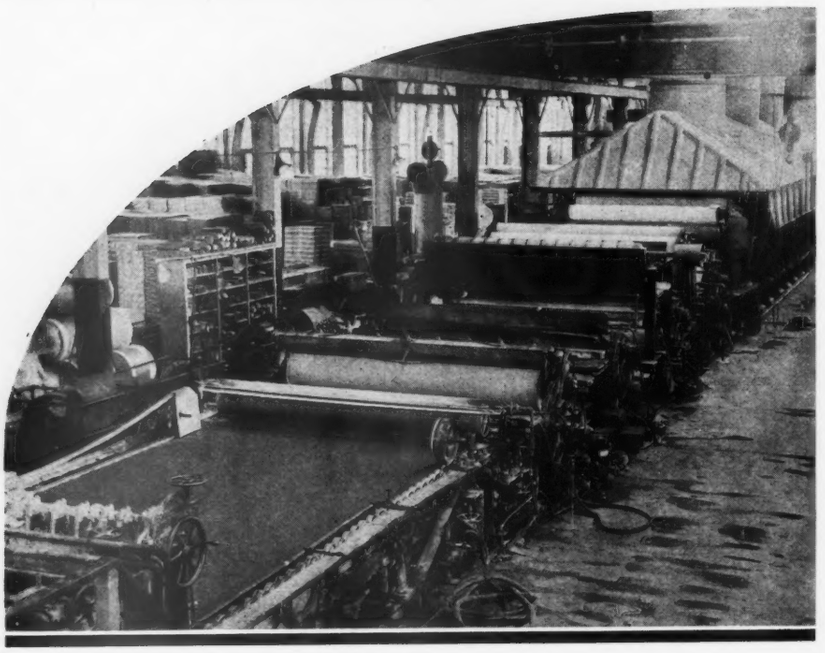



WATER
Gallons of Water Used per Lb. of Packed Product
100
75
50
25
0
Start of drive
16 month
average 37.4 gal.
J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D
1933
1934
1935



C. W. CURTIS
The Munising Paper Company
Munising, Mich.

★



ALWAYS on Schedule

If you operate big, expensive machinery, here's your schedule board. Specially designed to keep two paper-making machines busy, it's readily adaptable to any others where the time element may be predetermined with a fair degree of accuracy

★

OUR CONCERN operates two Fourdrinier machines. All of its 30 and more varieties of sulphite papers must pass through one of these machines. From the standpoint of keeping delivery promises, as well as of reducing the substantial cost of idle machines or of changing machines over from one type of stock to another, we found that the simple daily list of orders on which our schedule was based did not give a sufficiently clear picture of the situation. Too many orders would be scheduled for some weeks, and the mill would be unable to keep delivery promises. Perhaps the very next week (too late for the sales department to get business to fill up the idle periods) the machines would be down for lack of work.

So a Schedule Board

A better plan had to be found, and with the assistance of a firm specializing in this work a schedule board was developed to meet the need. It is divided vertically into fourteen columns, giving a space for each day of a 2-week period. Space for each day is divided by hours. Each vertical column is divided into five sections, making it possible to show day by day and hour by hour the schedules of each of the two paper-making machines for the ten-week period ahead. Running the length of the board for each of the five divisions is a pair of metal guides to hold job tickets, one guide for each Fourdrinier machine.

The job order is of the usual type except for a ruling along its upper margin that corresponds in scale to the hourly time scale marked on the board. As the order clerk fills out the job ticket, he notes in the indicated spaces the hours required for set-up and for running, and marks total hours required along the ruling at the top of the card. If more than 10 hours are needed for any job, additional job tickets are filled out to give total time requirements of the order.

Job tickets are now placed in the guides on the schedule board, being overlapped so that only that portion of the card shows on which the required time is indicated. Thus, when the cards are in place, order of work and hours for each job are graphically indicated. *So long as there is no change of schedule, all that is necessary to keep the mill going on schedule is to give out the orders as the time for starting them arrives.*

Wire Shows Up Late Orders

To indicate whether the schedule is up to date, a vertical wire is moved along the face of the board from hour to hour and day to day. All work to the left of the wire, on the line indicating the current week's schedule, is thus behind schedule. This wire and the small helical springs that keep it taut may be seen at about the middle of the board.

As each 2-week period is completed, the small cards above the

guides, showing the date, are advanced to pick up the date consecutively from the last date indicated on the line above. The current week may be anywhere on the board, the schedule working downward and then starting at the top again.

Completed tickets for the previous day are removed from the board every morning, and actual time required to run the order is entered in the proper space. Comparison of actual with scheduled time provides the basis for a production bonus to the machine crews.

Job tickets are distinguished by color or by the diagonal or crossed lines seen on some of the forms on the board. Each color or distinguishing combination corresponds to a particular formula for the "furnish," as the raw material for paper is called in the industry. Weight of paper is indicated by punches at the left-hand margin, and the color of paper called for is written on the order.

In making up the schedule, the order clerk has before him a tabulation of the set-up time required to change from any grade or weight of paper to any other, also the wash-up time required between the various colors. Hourly production rates for each grade are also tabulated. These rates are set at about 90 per cent of the actual average rate of production, thus allowing a margin of 10 per cent for exceptional delays such as breakdowns, and for such expected delays as changing felts or wires.

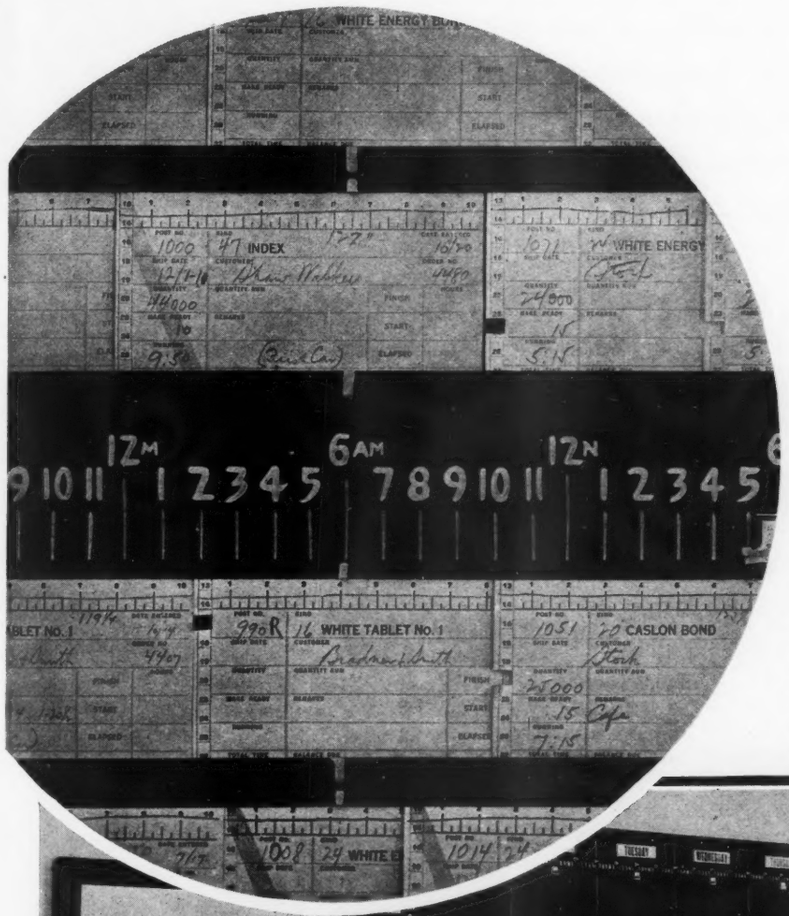
Even Rush Orders Allowed For

As orders are received, the order clerk puts them on the board, primarily according to date of shipment promised, but arranging them also for best manufacturing sequence. Certain large contracts call for periodic shipments; these are tentatively scheduled even though definite shipping instructions or specifications have not been received. In future weeks there are usually open dates; if possible, some time is kept available for the special rush orders that come in from time to time. Should these open dates not be taken up as they become current, other orders will be moved ahead or stock items put in to fill the gap.

The time allowance of 10 per cent tends to keep delays from accumulating in the schedule However, when the delays do come, they are apt to come in a lump—an hour, for ex-

(Continued on advertising page 43)

WET END of one of the two Fourdrinier machines at the Munising Paper Company. If they're ever idle, it's no fault of the schedule board shown below



SCHEDULE BOARD (14½x3½ ft.) shows what's ahead of each of the two Fourdrinier machines day by day, hour by hour, for the next ten weeks . . . Arrow points to wire that is moved ahead hourly, thus automatically dividing current week's schedule into "late" and "on time" sections . . . Job tickets (3x5) are colored or otherwise marked to indicate basic formulas (see circled close-up); framed display at left of board serves as key to colors and markings

Upped Output Nine Times

C. S. McCHESNEY and **H. E. ELDEN**
Superintendent — Technical Manager
Engineering Division, Dunlop Tire & Rubber Corporation
Buffalo, N. Y.

★

How, to meet increased demand for a new product, a purely experimental handling installation was replaced by a complete conveyor system—how capacity was increased nine-fold in, to be sure, three times as much floor space but with the same number of people

★

DUNLOPILLO is one of the rubber industry's newest products. It looks much like sponge rubber and contains countless inter-connected air cells which make it especially useful in the building of more comfortable automobile, bus, and airplane seats, as well as applicable to many household and office furniture requirements.

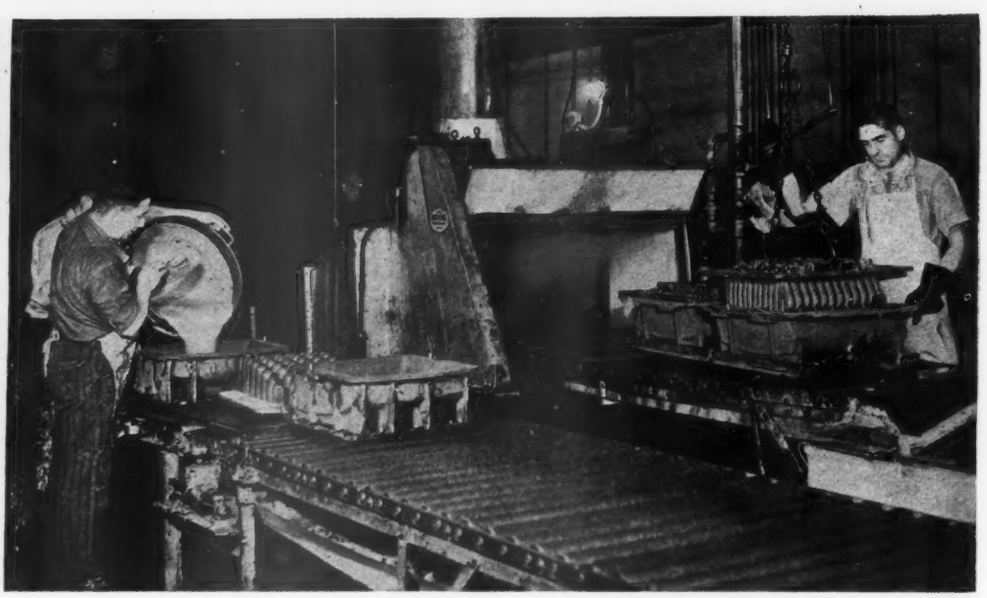
Molds used in making this material weigh up to 500 lb. each, are therefore much too heavy for one man — or several men, for that matter—to handle. Obviously some mechanical means of handling them had to be supplied, and in the early stages of Dunlopillo experience we set up an experimental installation consisting of tramrail system and electric hoists. This method had a single fault—each mold had to be handled four separate times during the manufacturing cycle.

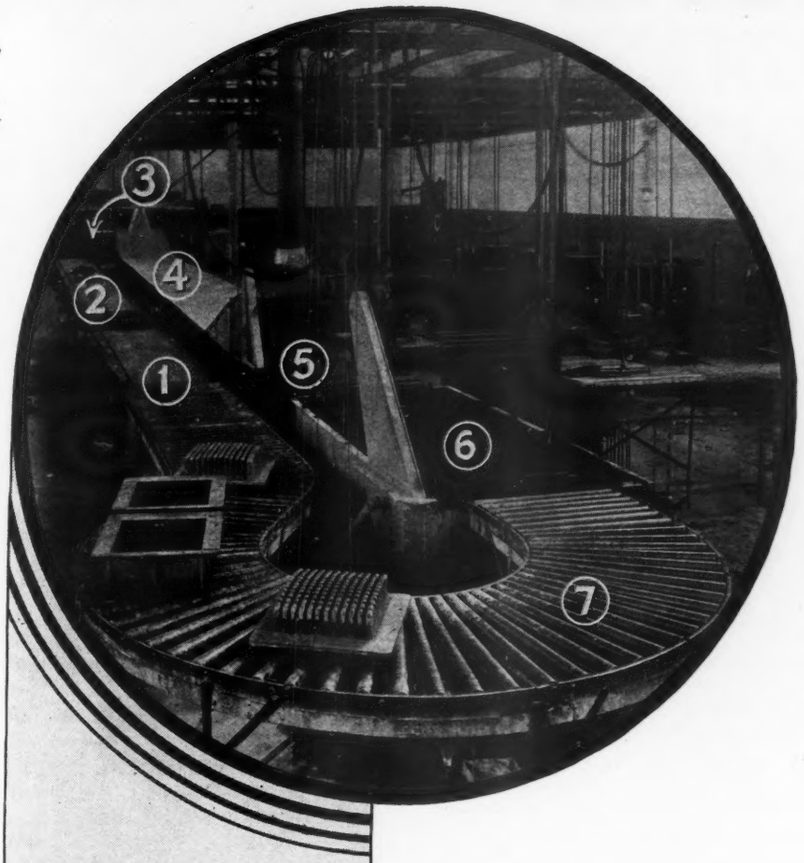
So long as the operations were on an experimental basis, this handling and rehandling constituted no serious drawback, but as the commercial demand for the new material developed, a new set-up was needed to facilitate operations and reduce costs. A new conveyor system (Mathews) was therefore designed and installed. The conveyor is supplemented by an electric hoist that is used to remove mold covers when the product is stripped from the molds.

With about three times the floor space but with the same number of operators, it is now possible to obtain nine times the production previously available. It would be unfair to compare costs because the original handling set-up was purely experimental, but it is evident that a very considerable decrease in manufacturing costs is being obtained coincidental with the increase in manufacturing volume.

Latex as it comes from the tree has a rubber content of 38 per cent dispersed in water. In the manufacture of Dunlopillo, this latex is centrifuged in special machines until the rubber content is 60 per cent. The latex, in 2,000 gal. lots, has 0.5 per cent of ammonia added as a preservative, plus vulcanizing agents and other compounding ingredients in water suspensions.

To small quantities of the resulting mixture, is added a predetermined amount of a froth-producing agent. The ratio of volume of air to latex compound is controlled by





COMPLETE VIEW of molding operations showing (1) filling point, (2) belt conveyor, (3) 180-deg. live-roller curve, (4) hot-water (vulcanizing) tank, (5) roller conveyor on which molds are stripped, (6) cold-water tank in which molds are cooled, (7) gravity roller curve on which molds are dried, lubricated, and brought again to the beginning of the cycle

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Beginning and end of Dunlopillo molding cycle. A bus seat mold has just emerged from its 60-min. bath in the vulcanizing tank, and the electric hoist operator is lifting the lid preparatory to stripping the mold and sending it into the cooling tank at his left. Across from him, at the end of the gravity roller conveyor and the beginning of the belt conveyor, are two operators pouring the mixture into another bus seat mold and starting it on its way through the cycle

the time of frothing, and is varied according to the density required in the final product. At the end of the frothing time, a small quantity of a gelling agent is added which in approximately 10 min. causes the froth to set.

It is this final mixture that is poured directly into the molds, so that the setting of the froth will occur in the molds forming the final shape of the product. Inasmuch as the froth is liquid when poured, complicated and deep molds of any structure or design may be easily filled. These molds, which have been placed on the belt conveyor prior to the pouring operations, travel a distance of 97 ft. in 26 min. to a roller chain, steel-pallet conveyor which runs through a tank of hot water held at 205 deg. F.

During this handling of the molds it is necessary that vibration be kept to a minimum to prevent the breakdown of the froth during the setting period. The belt conveyor has an approximate speed of 1.2 to 6 ft. per min. The pallet conveyor carries the molds through the hot water tank at a speed which can be varied between 0.5 and 2.5 ft. per min. Immersion is for 60 minutes, during which time the product is vulcanized.

Speeds Fit Needs

To eliminate congestion at any point, the lengths of the sections of conveyor devoted to each process were determined by calculating the approximate time required for each of the respective processes. This timing is maintained by means of Reeves variable-speed transmission units. A section of gravity roller conveyor affords additional flexibility. Connection between belt conveyor and hot-water tank conveyor is made by a Mathews 180-deg. chain-driven live-roller curve, which makes use of tapered steel rolls to convey molds radially during their travel from belt to entrance of tank.

As molds emerge from discharge end of tank, they move directly to a roller conveyor where lids are opened and product is removed. Empty molds continue on the conveyor through a tank of cold water from which they emerge to be air dried, lubricated, and started again on the cycle.

Connecting link between discharge end of cold-water tank and belt conveyor consists of a 180-deg. roller-conveyor curve set at a sufficient grade to move empty molds by gravity.

FOR EVERY HANDLING JOB, controlling factors govern final choice of equipment. Here, when conditions changed from an experimental to a production basis, conveyors replaced a tramrail system. The situation might have been reversed. Or circumstances might have been such that industrial trucks would have served better than either tramrail or conveyors. It is the old, old problem of picking the right equipment to do the particular job at hand

Fundamental economic facts in palatable form. Tools by which management can offset crackpot theories. Such are this article and its December predecessor on the 30-hour week. Use them by seeing that workers read them. Available in convenient booklet form, suitable for pay envelope distribution, at small cost

If the worker only knew

Would he favor the Townsend Plan?

"Walking home, Ed?" Sam asked the question as he and Big Ed brushed up the chips that had been bouncing from their planers to the floor and out into the aisle.

"Sure, Sam. You walking? Something on your mind?"

"Yeh. Got somethin' I want to talk about."

Hands cleaned and overalls already off, the two men locked their tool chests just as the whistle blew and headed for the time clock and the main gate.

"What is it, Sam?" asked Ed, as they stepped through the gate.

"It's that Townsend Plan. Lots of the fellows say it's coming and if we can just keep going till we're 60, we'll be fixed for life. Seems to me that with all your readin' you ought to know if it'll work."

"Well, I'll give you my honest opinion, Sam. I've made up my mind, all right. Partly from reading, I guess, and partly from just common sense. You know what the plan is, don't you?"

"Guess so. The way I get it, the idea is that when a person reaches 60 he stops work and the government pays him $200 a month the rest of his life."

"Yes, that's it. But there are a few items you didn't mention. The $200 has to be spent during the month received. And the money has to be raised by us workers. And—"

"Wait a minute, Ed. How come *we* have to raise the money? Doesn't it come from Washington?"

"Sure it does. But where does Washington get it? From taxes. And we pay the taxes."

"Well, that might make a difference. Seems to me taxes are high enough now. Would there have to be extra taxes for the pensions?"

"*Would* there, Ed? *I'll* say there would. You know the state sales tax you gripe about. Well, that's *nothing*. For those Townsend pensions you'd have a *transactions* tax. Every time something changed hands there'd be a tax.

"Take eggs. You'd get ham and *egg* instead of ham and *eggs* for breakfast—and a mighty small piece of ham at that. The hen that laid the eggs would have been born from a taxed egg in a taxed incubator, and raised on taxed food. Then her eggs would be taxed when the wholesaler bought them from the farmer. Again when the jobber bought them. Again when the grocer bought them. And once more when your wife bought them.

"You can figure the same thing out on your rent, coal, light, gas, clothes, smokes—even carfare."

"But I couldn't afford to pay all those taxes, Ed."

"Course you couldn't. But you would, if you had the Townsend Plan. You just wouldn't buy as much stuff as you do now. Neither would I. And neither would anybody else. Of course the people over 60 would have more to spend, but it would be money that you and I and a lot of other people donated. So total spending wouldn't be any greater."

You'd get ham and egg instead of ham and eggs for breakfast—and a mighty small piece of ham at that

"But the way it was explained to me, the plan would make more sales and more work."

"How could it, Sam? Take 1933, for example, just because I happen to remember the figures. The country had 48 billions of dollars of business. That averaged 4 billions per month.

"Now suppose we had started paying the $200 a month on the first of February. There were 10 million people over 60. Multiply 10 million by $200 and you get 2 billion dollars that would have had to be collected during January.

"But there was only 4 billions of business. Take 2 billions out of that for old age pension tax and there would have been just 2 billions left to spend.

"Then in February there would have been the normal 4 billions again plus the 2 billions set aside in January for the old folks, making 6 billions in all.

"The first thing, though, 2 of those 6 billions would have been taken as tax for the old people to spend in March, which would have left only 4 billions to be spent in February.

"The same thing would have happened every month in 1933. And that's just where we started—with 4 billions a month to spend. The only difference would have been that those who had money to spend to start with would have passed a third to a half of it over to other people to spend."

"And is that all, Ed?"

"It's enough, isn't it? But at that it's not all. Some more taxes would have had to be collected to pay a force of bookkeepers to keep track of the taxes, and payments, and age records, and applications for pensions—and the checkers to watch the old folks to see that they didn't save anything and didn't work."

"Don't tell me any more, Ed. I've got a headache now."

"All right. You're practically home anyway. But if you have a headache now, how would you feel if you had to begin tomorrow to raise your share of that 2 billion dollars every month? Goodnight, Sam. It's only a dream so far. Let's hope it doesn't turn into a nightmare."

Where Buick's $15,000,000 Went

Wherever possible, Buick has selected special-purpose machines in which operations are combined that would ordinarily be performed on three or four general-purpose machines. Typical example, this drilling and boring machine that combines a number of operations, saves a large amount of floor space

Next time someone tells you industry doesn't need to modernize, you tell him what's going on in the automotive industry. Buick's $15,000,000 program is just a good sample. The implication is clear. If plants that were the "last word" in production efficiency six short years ago now have to take such heroic measures, how much more desperate must be the need in a thousand and one other plants that never were the last word

★

Based on an interview with

HARLOW H. CURTICE

President, Buick Motor Company

[*This is the third of three articles that describe how Buick has gone after 1936 business with a simplified line and completely modernized plant. The first (December, page 498) outlined Buick's modernization policy and objectives; the second told what changes were actually made in forge shop and foundry. Now for details of what happened to motor-building and sheet-metal departments.*]

CHANGES in the motor-building or machine shop were initiated largely by design changes in the engines, principally by standardizing on two engines in place of four. Simplification in the layout and logical arrangement of unit production lines with respect to assembly lines became immediate goals. Throughout, of course, the objectives of increased precision and lower costs were paramount.

Nearly every piece of existing equipment was scrutinized from the point of view of its value in the new set-up. If a machine did not fit in, it was scrapped or sent to storage, later to be sold.

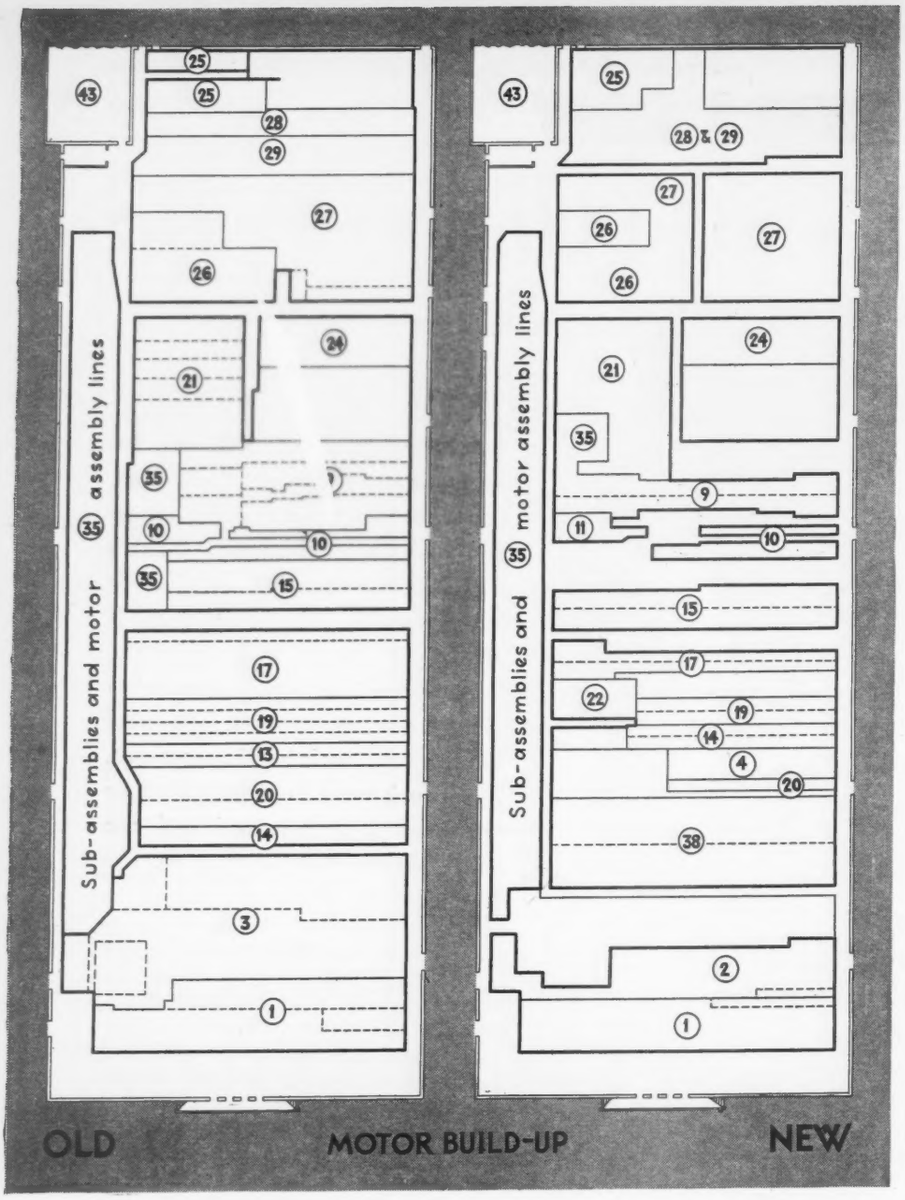
Of the money spent in the motor plant in preparation for the new models, charges were made against four major accounts as follows: (1) New machinery (capital account), 50.5 per cent; (2) machines rebuilt and repaired, 12.5; (3) tools and fixtures, 26; (4) plant rearrangement, 11. Total, 100 per cent.

The last three items are charged to current expense, and are generally absorbed over a period of two years, immediately following a major change in design. New machinery is depreciated on a 10-year basis, as explained in the first article (Dec., 1935, page 498).

In the process of throwing out old equipment and substituting the most modern machinery obtainable, a great deal of space has been saved, making it possible to bring in the crankshaft machining line from another building, as indicated in the layout.

Space has been saved despite the fact that current production will be almost double that of last year. Additional shifts account for some of this increase in volume. Wherever possible, however, special-purpose machines have been selected in which operations are combined that would ordinarily be performed on three or four general-purpose machines.

One machine, for example, rough and finish bores both the large and the small end of connecting rod forgings, then saws off the cap. Rods are machined four at a time. Formerly, three set-ups were required. Another special-purpose equipment bores the camshaft bearings as well



as the main bearings of the cylinder block in one set-up, this being the first time these operations have been combined.

Controls? Automatic, of Course

Advantage has been taken of the newest automatic controls. Pistons, for example, are equalized in weight on a special end-milling machine in which the depth of cut is regulated by the weight of the pistons on the weight pan of a scale. The heavier the piston, the lower the pan sinks and the more metal is removed from two internal balancing lugs.

Another example is automatic sizing control of finish grinding on the camshaft, which is accomplished by mercury-column switches actuated pneumatically through orifices controlled by the work size.

An example of revision to improve quality is found in the constant-temperature room where piston sets are matched against the bores of the block in which they are assembled. Piston diameters are measured under large-scale electric gages, and segregated in ten steps, each step being 0.0003 in. With a metal of such high expansivity as aluminum, such fine segregation would be impractical unless carried on at a uniform temperature.

Bores are gaged internally in similar steps as the blocks go down to the assembly line. By Telautograph the checker reports the motor number and the bore steps in a given sequence. From the written record at the receiving station in the constant-temperature room, pistons are selected to correspond. The torn-off record stays with them as they are assembled to connecting rods and placed on trays carried on monorails. By the time the tray reaches the assembly line, it is above the motor to which its cargo belongs.

As the floor plan shows, there is straight-line flow of raw stock from the loading dock on one side to the two assembly lines on the other. Furthermore, the arrangement of operations down the floor is in the logical sequence of motor build-up. Backtracking is almost entirely avoided, except heat treatment of camshafts, performed in an adjoining building. That is why camshaft production is carried on at the north end of the line, instead of being alongside of crankshaft production lines. Anodizing of the new aluminum pistons, on the other hand, is accomplished directly in line with the last machining operations.

In the Paint Line

Buick bodies are made by the Fisher Body Division, but such stampings as hoods and fenders are made in the Buick plant. A number of important changes have been made in the paint line for hoods and

MOTOR BUILD-UP

OLD LAYOUT

Dept.	Part	Model
3	Crankcase	40
1	Bearing caps	40
1	" "	50–60–90
3	Crankcase	60–90
3	"	50
14	Flywheel	50
14	"	40–60–90
20	Valve lifters	All
20	Rocker arm brackets	All
19	Flywheel housings	40
13	Valve lift guide	90
13	" " "	60
13	" " "	50
19	Flywheel housing	50
19	" "	60
19	" "	90
17	Pistons and rings	All
15	Conn. rod caps	40
15	" " "	50
15	" " "	60–90
10	Water pump parts	50–60–90
10	" " "	40
10	Valve stem guides	All
9	Cylinder head	90
9	" "	40
9	" "	60
9	" "	50
21	Manifolds	40–60–90
21	"	50
21	Heater body, oil pump	
21	Intake manifold	40
21	Oil pump	40–60–90
21	" "	50
24	Misc. parts	All models
26	Timing gears	" "
26	Flywheel ring gears	" "
27	Automatics	" "
28–29	Camshafts	" "
25	Rocker arms	" "
43	Heat-treat	

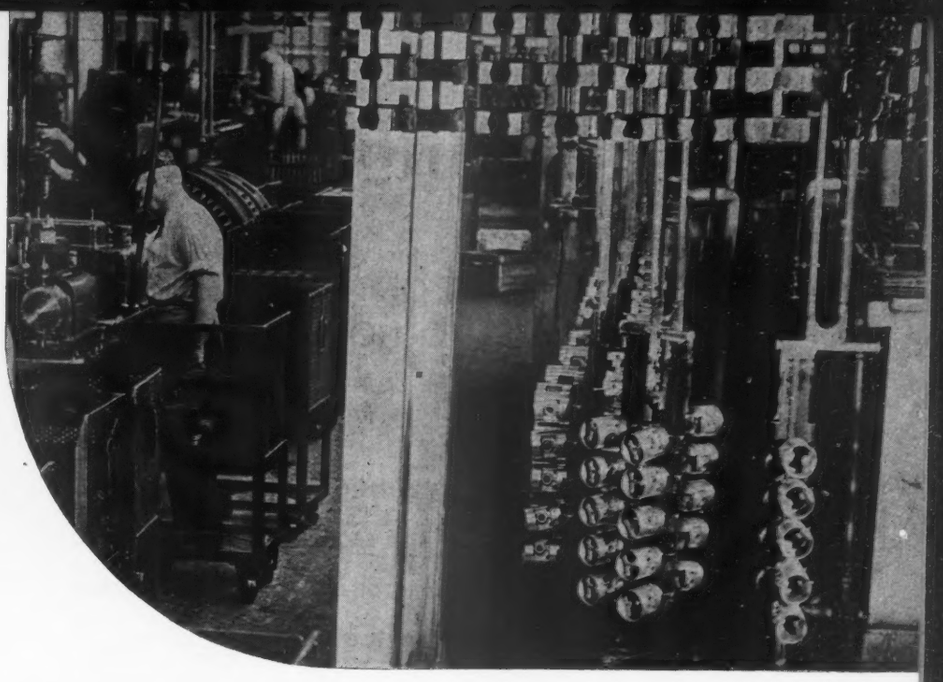
miscellaneous sheet-metal parts. A section of the floor has been partitioned off from the rest of the building, and filtered air is supplied under slight pressure so that all leakage is out, rather than in. Two fans on the second floor draw in air through banks of glass wool filters and distribute it through header ducts extending along the ceiling of the first floor. Unit heaters warm the air in winter, as the original heating equipment on the second floor was not designed to handle the number of air changes an hour now produced.

Five Quick Coats

There are ten hydro-filter spray booths in this section, illuminated by vapor- and explosion-proof lamps. Stray sprayed lacquer impinges upon a water curtain on the sloping back wall, and any free solvent vapor is drawn by means of a suction fan up through tubes sprayed with water from a central pipe. The water drains to a catch basin where the floating lacquer is skimmed off.

Booths are arranged in pairs, so that first one side of the piece, then the other, may be sprayed. By using quick-drying lacquers, it is possible to apply five coats in succession, with only a few minutes between coats. After the fifth coat, however, the work is conveyed to the floor above, where it winds back and forth in a drier for 32 min. before descending to be removed from the line.

In order to provide absolute uniformity of colors to correspond with the body colors sprayed by the Fisher plant, a central lacquer mixing room has been provided. There are ten standard colors, piped separately to each booth. Over three miles of $\frac{3}{4}$-in. pipe has been installed. Such an arrangement saves space that would otherwise be cluttered up with individual 5-gal. mixing tanks, diminishes the fire hazard, simplifies housekeeping, and eliminates trucking of drums to each booth. There is practically nothing on the floor, which can be hosed down each weekend without a general clean-up beforehand.



Backtracking is eliminated by having process operations, such as the anodizing of aluminum pistons, carried on immediately alongside the preceding and succeeding machining operations

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To take advantage of recent advances in rust-proofing processes, the department in which this work is carried on has been completely revamped. Heretofore the procedure was to dip the stampings in the phosphate solution, and with a continuous conveyor, it is necessary to provide sufficient solution to keep the stampings in treatment for the required length of time. For Bonderite B chemicals, this time is $4\frac{1}{2}$ min., and for the conveyor speed selected, 48,000 gal. of solution was required, at 212 deg. F.

The new process uses a spray at 170 deg. A series of small standpipe sprays force the solution against the metal from every angle, and by recirculating the liquid only 10,000 gal. of solution is needed. Time is cut to 1 min. Even with a lower acidity, the pressure spraying accelerates the chemical reaction and produces both a cleansing and a coating action in one operation. Because of the lower temperature involved and lower volume of liquid, the saving in process steam is tremendous. (For other details, *Factory*, Oct., 1935, page 427.)

Modernize, the Word

Thus, the slogan in every department has been *modernize*, take advantage of all recent design advances in machinery and allied equipment in order to do the job better and at lower cost, or to put in the added refinement of quality that could not be obtained on older machines. Buick has staked a $15,000,000 bet on the principle that increased value has its own reward in increased sales volume, which makes the added value possible from the profit angle.

NEW LAYOUT

Dept.	Part	Model
1	Crankcase	40
1	Bearing caps	40
2	" "	60
2	Crankcase	60
38	Crankshaft	60
38	Crankshaft	40
20	Rocker arm brackets	40–60
4	Clutch	40–60
14	Flywheel	40
14	"	60
19	Flywheel housing	60
19	" "	40
22	Bal. wgt.—Fan pulley	40–60
17	Pistons and rings	40
17	" " "	60
15	Conn. rods and caps	40
15	" " " "	60
10	Water pump parts	60
10	" " "	40
11	Valve stem guides	40–60
9	Cylinder head	60
9	" "	40
21	Oil pumps, manifolds and heater bodies	40–60
24	Misc. parts	40–60
27	Automatics	Both
28–29	Camshafts	"
25	Valve rocker arms	"
43	Heat-treat	"

Organizing for Recovery

2. WHY THE ONE-MAN BUSINESS COMES TO NO GOOD END

★

Continuing our examination of typical industrial organizations with the sad case of Mr. A who has always insisted upon shouldering the entire burden of running the Equator Corporation

★

FREDERICK A. SMITH
President, Miller, Franklin, Bassett & Company
New York

LAST month's installment of these articles urged upon industry the need to strengthen its organization, weakened by the panic exigencies of the depression. It proposed to show by example what had happened to three companies in the same industry, with widely different conceptions of organization, in order to determine what features of each could be advantageously retained or discarded to meet the anticipated competition of the future.

The first of these conceptions is the "one-man" organization, familiar to manufacturers since the beginning of the machine age. It has worked in the past, when each early industry sprouted from the brain of one man. But it is not so certain that it will work in the complex industrial relations of the future. Under it, each executive job in the plant is known to one man only.

Meet the Equator Corporation

A typical illustration of the workings of the one-man plan is provided by a manufacturer of an article of wearing apparel. Since the story is authentic, it can be identified only as one whose processing requires the preparation of raw material, a series of wet operations including dyeing, and another series of finishing operations that require expert hand and machine work. Altogether, the process calls for a specially trained and experienced plant organization.

The business of this company—let us call it the Equator Corporation—is seasonal, requiring a heavy investment in both in-process and finished goods. It is subject to style fluctuations. Sales are made either directly or through distributors. Moreover, the product is in demand in a wide variety of grades, from those of the cheap, large-volume market, running into millions of units a year at, say, $3 apiece, to expensive models selling to the quality trade at $10 and more.

The proprietor of the Equator corporation, Mr. A, graduated 40 years ago from a job as shop foreman into a modest plant of his own. He believed in quantity production of a low-cost model and was instantly successful in his venture.

His plant, which grew by leaps and bounds, was geared up to uniform production by the use of machines, impossible to his competitors in the higher grade lines. His sales problem was simplicity itself, since he quickly established relations with distributors and, later on, with chain stores whose sole preoccupation was volume. Advertising and packaging did not enter into sales costs at all. Price alone was the determining factor. So he settled down to produce all the standard units the traffic would bear.

Being somewhat of a Henry Ford by training and temperament, he built up an organization of foremen who knew their standardized jobs better than any others in the business. And being a man of caution, he insisted that each foreman should train an assistant or understudy to know the job as thoroughly as he did. He carried this same system through his manufacturing and en-

. . . if anything happens to Mr. A (he is 70), where will the Equator Corporation be?

gineering departments, as well as through his office to the top or just below it, for he himself had no assistant and would not hear of one. That was the Achilles' heel in his plan of organization.

About 1926 came the era of mounting prices. Competitors yielded to temptation and stepped up into the next higher class of products; they could be sold just as easily, and the profit was greater. Mr. A, observing this phenomenon, perceived a wider and wider price gap opening up between his steadily selling goods and those of the next higher grade. He meditated: Why should he not step his grade up, too, and fill the gap? He did so—with far-reaching, if unforeseen results.

Here's What Happened

The chain stores and dealers promptly dropped him and his several new lines. They were now quality products in a higher price class, and his established retail trade would have none of them. The price of the lowest grade had gone up anyway, about as far as that traffic would bear. Besides, certain chains are usually on the lookout for some manufacturer who will sell his goods at less than they cost.

Less ambitious manufacturers crowded in to supply the demand abandoned by Mr. A. So he was compelled to resort to direct sale to the retailer. This necessitated the creation of a large sales force, a sizable advertising appropriation, and expensive packaging. Meanwhile, his several new lines complicated the process of manufacture built around a single grade. Assistants and understudies throughout the organization were speedily absorbed as principals by the necessary new departments.

The same process continued up through the higher works management to the top.

Prices reached the 1929-30 peak, hesitated briefly, and descended with ever-increasing momentum to unpredictable lows. As they tobogganed, A, like many another, inaugurated drastic economies among his personnel. The word "assistant" disappeared from the payroll. Either the assistant was laid off or his chief was discharged and the assistant promoted into his place, with the latter course being the more common procedure, even in the executive offices where tried and competent secretaries were replaced by ordinary stenographers. There were heavy salary cuts.

The present Equator organization consists, to a great extent, of not very competent people who are in daily dread of losing their jobs. According to recent reports the company has gone back to its old low-price line and is now trying to re-establish itself with the chains and the dealers.

. . . having someone ready to jump into the boss's shoes is a basic precaution

Now the status of the organization is such that, if a foreman should quit, his department would be demoralized until a new man could be broken in. If a superintendent should quit, a whole section of the plant would go into a modified revolution for a while. But if A becomes disabled (he is 70), what is to become of the business?

This plan of organization, with one man covering each important job, has worked for a time, where the head of the firm was an extremely hard and able worker and where the department heads were young and strong. Sooner or later, however, came the breaking of some link in the chain, followed by a general and often a permanent drop in the over-all efficiency of the plant.

Many another plant with similarly organized personnel comes to mind. They are all one-man outfits, and in addition to the usual weakness of that type of organization, they all have one fatal trait in common. That is internal jealousy, the destroyer of organization morale.

No Competition

The one-man system by its very nature discourages the open and sporting competition that is the life of good organization and fosters the dark and suspicious envy that is its death. The lone individual at the top is too busy with his self-assumed load of routine to have time to study his men, build up their morale, and create opportunities for them to show how good they are. His hard-driven executives, left to themselves, unnecessarily fearful of their jobs, surround themselves with secrecy and watchfulness, spend half their time thinking up alibis.

It would be superfluous to advance further illustrations of the inefficiency of the one-man plan of industrial organization and a waste of energy to try to discover any virtues it may have. It is unsuited to the plan of reconstruction of present weakened organization that we are urging. For, as we shall see, understudying executives is one of the basic precautions to be employed in building a strong organization.

No careful driver starts a trip without a spare, especially when the other tires are a bit worn.

Business IS better. Definitely. And no wishful thinking about it. Look out the upswing doesn't hit you before you're ready. For most concerns that means modernizing not only physical plant, but—equally important—human structures. Industry, as we have seen in the past half-dozen years, can dissipate its investment in manpower just as it can let buildings run down

Plainly the one-man organization is out. In March, a post mortem over the concern that went outside for its talent

FIGURE 1. Old Method. Tolerances were small. Hence it was felt necessary for the left and right hands to aid each other in fitting the plug gage into the bushings. This is the second operation detailed in the process chart (see Figure 3)

"Gage and Inspect"

1. BEFORE MOTION STUDY

G. J. STEGEMERTEN
Superintendent, Time Study Department
Westinghouse Electric & Manufacturing Company
East Pittsburgh, Pa.

★

Here's a job that was originally done on a daywork basis. First attempt to improve it was by putting the operator on incentive. Result, a saving in time of 40 per cent. More intensive study increased this saving to 52 per cent. That's this month's story. Next month, what happened after motion study

TO ILLUSTRATE the practical application of motion analysis principles, the operation of "production inspection" has here been selected. The part inspected is a gear bushing. It should not be implied from the simplicity of the operation that applications of motion analysis are limited in any way. This job just happens to lend itself readily to a demonstration of the principles involved.

First of all, this inspection operation was originally done on a daywork basis. Obviously it was taking more time than necessary, but it was not convenient at the moment to subject it to intensive analysis.

In order, therefore, to take advantage of increased production that comes through the use of incentives alone, the job was soon placed on standard time. The move resulted at once in an approximate reduction in time of 40 per cent. Under the circumstances the move was creditable enough, and similar tactics are not to be discouraged provided they are recognized as only temporary expedients. It is often good practice to take advantage of the very obvious improvements until a more complete job analysis can be made.

Later on the job was subjected to a more searching study in the light of what we then knew about time study principles. It was evident that the arrangement of material supply was not very convenient, that one hand seemed to be doing more work than the other, etc., etc.

The bushing under discussion, as may be seen from the process chart (Figure 3) that was later made, requires four operations: (1) Gage length; (2) gage knurled diameter; (3) plug-gage inside diameter; (4) inspect visually for defective knurling, blowholes, etc. Each piece was handled twice—once for the first two operations, again for the second two.

At this stage the set-up included, first, a double set of gages for gaging length—both "go" and "no go"—and knurled diameters. These gages were mounted on a plate that could be fastened to the bench.

Second, the material was arranged conveniently on the bench with the

	WRIST	ELBOW (hinge)	ELBOW (ordry)	SH'LD'R
FINGER	18%	18%	50%	60%
WRIST		same	27	35
ELBOW (hinge)			27	35
ELBOW (ordinary)				7

FIGURE 2. Approximate amount of time required to change from one order of motion to another

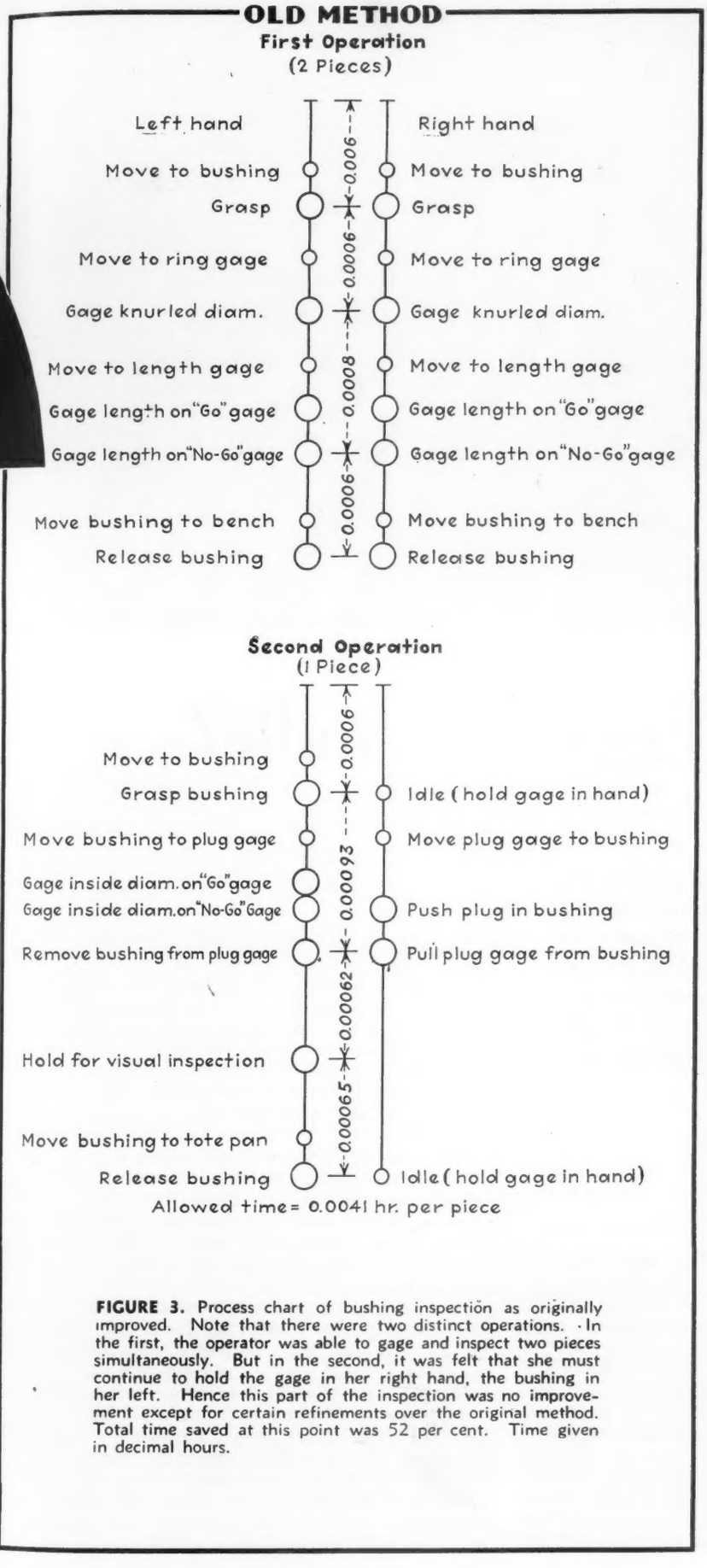


FIGURE 3. Process chart of bushing inspection as originally improved. Note that there were two distinct operations. In the first, the operator was able to gage and inspect two pieces simultaneously. But in the second, it was felt that she must continue to hold the gage in her right hand, the bushing in her left. Hence this part of the inspection was no improvement except for certain refinements over the original method. Total time saved at this point was 52 per cent. Time given in decimal hours.

gages between the operator and the supply. Thus the operator was able to pick up a bushing with each hand, gage knurled diameter, gage length, and lay the part aside on the bench. Also, the set-up put both hands to work, and at the completion, two parts were inspected in practically the same time formerly taken to inspect one.

The third operation—plug gaging—required that one part be done at a time, the right hand holding the gage while the left manipulated the bushing. It was generally felt that with such close "go" and "no go" tolerances it was necessary for the right and left hands to aid each other in fitting the plug gage into the bushing. The fourth operation—visual inspection—was combined with the third. This second half of the job was no different from the original method, but certain refinements counted for added savings.

Another change was made that reduced time. On finishing, the operator placed the good parts in a tote pan instead of on the bench. That eliminated another operation and, added to the savings already detailed, increased the original 40 per cent to 52.

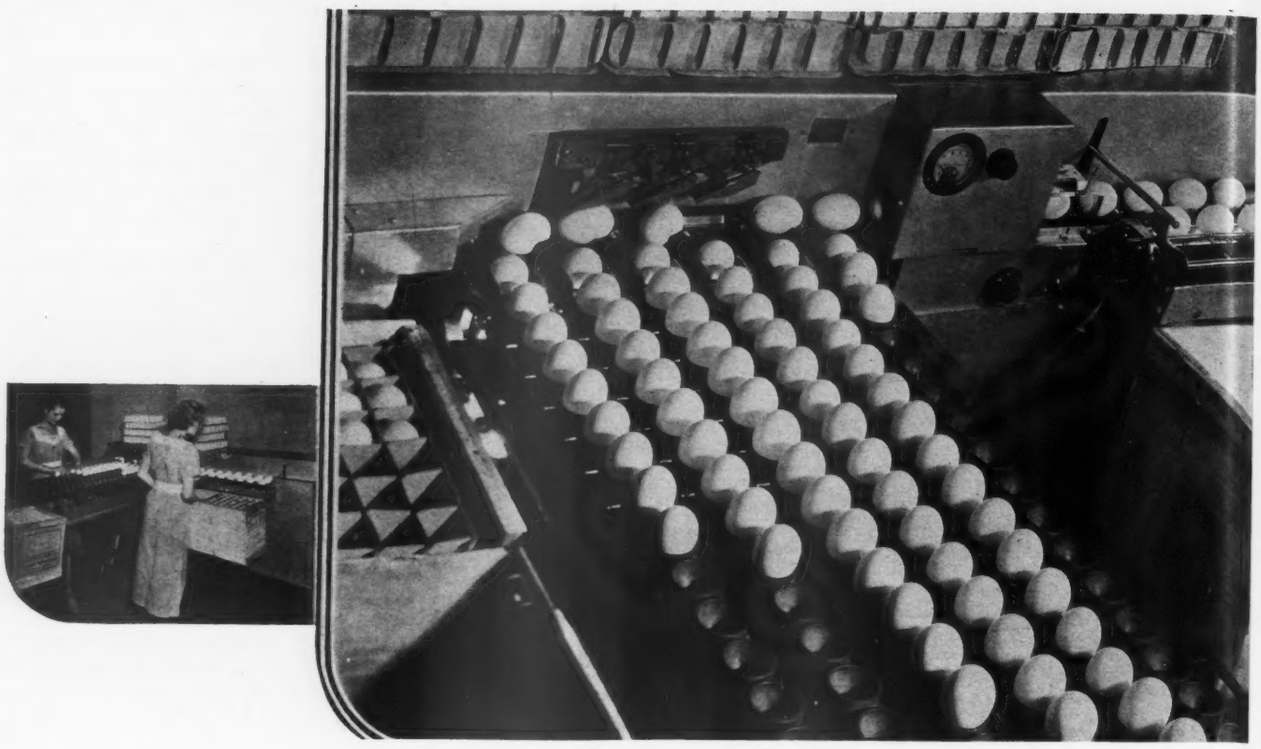
Then Came Motion Study

All this, however, was without benefit of motion analysis. Motion study not only subjects a task to the analysis thus far demonstrated, but it also breaks down motions into a very definite order—finger, wrist, forearm, shoulder, hip, and leg. Research made in connection with these various motions has determined the approximate amount of time required to perform one motion over another. See Figure 2.

Note that the figures in it are based on a constant movement distance of 4 inches. As a rule, when an arrangement can be made in the set-up to allow the change from, say, a shoulder to a wrist movement, the shoulder moves farther than 4 in. to accomplish its task or it wouldn't be a shoulder movement. Therefore the time saved in the change would be much greater than that shown. Also, the figures represent only the motion times, disregarding all planning and delays.

•

What happened to this inspection job after the motion economists went to work on it, is revealed in complete detail in a second article scheduled for March publication



What, No Eggs to Candle?

Of course you haven't. If, after reading this page, more than one or two plant operating men are interested in the "Seleggtor" as such, we shall be ever so surprised. That's not the motive. It's simply to prove how technological improvement (via the photocell in this instance) can put a tedious, hopelessly inaccurate operation on a truly scientific basis

CORTLAND G. SMITH
Assistant Editor

SELEGGTOR is what they are calling a new machine that makes use of the photocell for candling and selecting eggs. Developed by Kraft Egg Machine Company, Inc., Chicago, it has a normal operating capacity, with two attendants, of 12 to 15 cases per hour, thus promises to revolutionize what has always been a painfully tedious and exceedingly rule-of-thumb operation. It is indicative of what technological development has in store for those who take full advantage of its offerings, and that, of course, is why we're telling you what we know about it.

Operation combines one photoelectric grading with two visual inspections. Girl places eggs on "loading deck" (shown at right in small photograph). Here eggs are rotated over powerful inspection lights, first rapidly to show the yolks, then more slowly and in opposite direction for dirt and surface defects. Lights are carefully placed so that they do not shine in the inspector's eyes.

After this preliminary examination, eggs are automatically transferred to small conveyor, which advances them one by one through shutter-controlled beam of light, where photocell measures proportion of firm white to yolk, thus "scoring" interior quality. Color of shell doesn't confuse the scoring as it does in visual candling.

Thus Seleggtor grades eggs into four quality groups, and further divides top-grade eggs into large, medium, and small sizes, each egg being deflected into one of six rows of rubber cup conveyors.

As each egg is deflected, conveyor advances and presents another cup for next egg. Rubber cups have opening in bottom. Inspection lights below eggs allow operator to give them third inspection before she takes them off and places them in packing cases or cartons.

Seleggtor handles eggs so gently that checking or cracking of shells is less frequent than when ordinary hand candling methods are used.

Depreciation Dollars

Mere bookkeeping figures or actual cash money? One won't buy needed plant and equipment. The other will

★

WILLIAM LUCIUS CHURCHILL
Vice-President, The John R. Hall Corporation
New York

SUCH tremendous need for construction of buildings and equipment was never known in American history. An unpredicted boom in the capital goods industries will result from meeting the need for reconstruction and replacement of only our wholly depreciated buildings and other capital goods.

Regimentation of industry or business is unnecessary. Agreements among competitors are not required. Individual initiative and independence of action may be retained by every enterprise. Horse-sense understanding of one of the most misunderstood, misused, and abused economic elements — *depreciation*—is all that is required to start the business boom.

As Real as Bricks

Depreciation is a reality. It is not a bookkeeping figure. Depreciation is just as real as the bricks in the buildings, as the gears in the machinery. To make a sale without including adequate depreciation is like giving customers bricks out of the building or gears out of the machine used. Omitting depreciation from costs and prices is just as destructive and far more dangerous.

The really successful enterprises —those that are continuously successful—set aside depreciation reserves as actual funds to be expended only for restoration of depreciated values. They recognize these funds as having been received from customers for the purpose of maintaining plant and equipment in prime condition *and for no other purpose.*

These progressive and farsighted concerns further recognize that they owe a duty to their stockholders to maintain the integrity of their investment. To maintain this integrity requires the intelligent use of adequate depreciation reserves to maintain full earning value of depreciable assets. They also recognize a duty to society to keep property and equipment from deteriorating and becoming menaces to health and safety. They recognize that it is just as important to expend depreciation reserves to offset depreciation's ravages as it is to collect them from their customers by including them in their costs.

A typical illustration of the benefits that accrue from recognizing depreciation as a reality relates to a small enterprise that adopted the policy in 1909 of setting aside actual cash reserves represented by a liberal depreciation account charged into costs and collected in prices. At that time it owned only sufficient machinery and equipment to employ about 40 workers. Today it owns land, modern buildings, and equipment for the employment of more than 800 people. It has climbed from an obscure position to the unchallenged leadership in quality and low cost of products and services, stability of earnings, and a reputation for progressiveness in a highly competitive industry.

★

If every industrial concern had set up real depreciation reserves prior to 1929, enough actual cash would be on hand to satisfy today's tremendous need for construction and replacement. The capital goods industries would hum. Recovery would be in the bag

★

In the search for better equipment in which to invest depreciation reserves and to replace depreciated facilities, it has encountered opportunities to add profitable items to lines of manufacture that otherwise would have remained undiscovered. Its progressiveness in handling depreciation reserves is merely an indication of the general alertness that has resulted in developing an insignificant local industrial unit into an internationally known enterprise.

Progressive enterprises that reserve adequate depreciation funds with which to maintain properties in prime condition frequently have to take exception to governmental rulings in regard to maximum allowable charges for depreciation in income tax returns. Their reports to stockholders may show greater charges for depreciation than the government permits to be included in operating costs. This in turn leads to payment of income taxes on that portion of depreciation reserves that may be in excess of the amounts allowed by our taxing bodies.

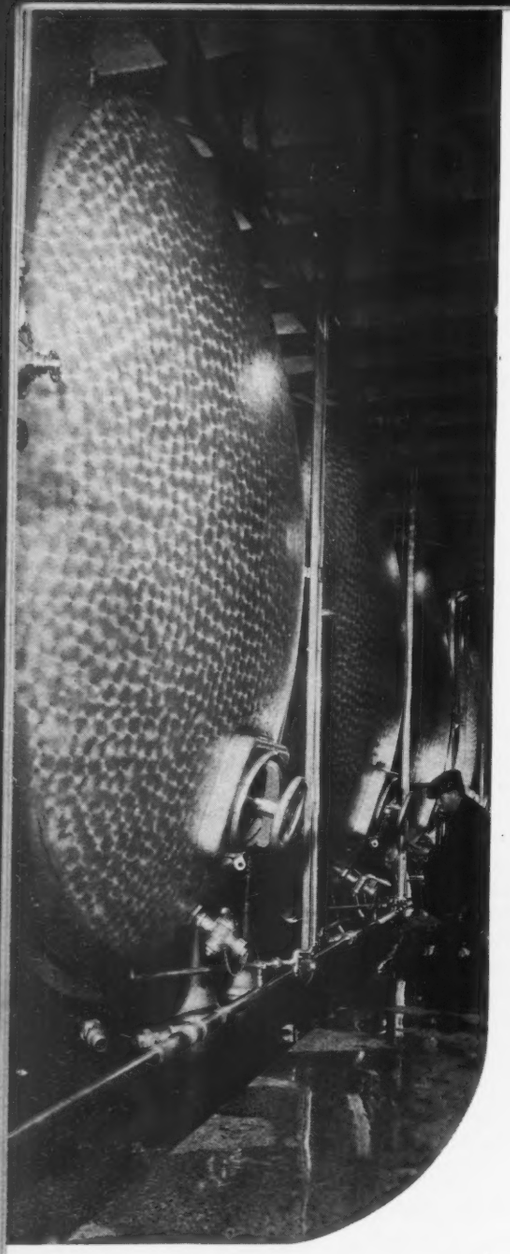
To Minimize Income Taxes

Enterprises that endeavor to keep depreciation charges down to as small dimensions as possible in order to make the most favorable profit showing to their stockholders are the readiest to claim the maximum depreciation allowed by the government in compiling income tax returns.

Unfortunately the concerns that make duplicate earnings reports of this type rarely have even the smaller depreciation reserves that they report to their stockholders in funds available for replacement of depeciated assets.

Enterprises that use depreciation reserves as a means of minimizing income taxes are apt not only to fail to reserve depreciation funds for replacement of depreciated assets, but also to use these funds for operating expenses and even to include them in dividends. Their balance sheets list depreciation reserves as a liability that can rarely be balanced by corresponding liquid assets. The

(Continued on advertising page 43)



Aluminum Is Fifty

Not what you'd call a ripe old age. Legitimate cause, however, for pausing to record progress made since that February day when Charles Hall discovered his electrolytic process — the same process that brought the price of aluminum tumbling down to a point where it could compete successfully with all the other common metals

★

LEWIS K. URQUHART
Associate Editor

FIFTY YEARS ago this month—on Feb. 23, 1886, to be exact—one Charles Hall, a year out of Oberlin and aged 22, burst into his professor's lab with precisely the same words that Archimedes is reputed to have used as he climbed out of the bathtub a couple of thousand years ago.

"Eureka," exclaimed the one in the original Greek.

"I've got it!" shouted the other in the somewhat more familiar English translation.

What he'd got was a process—an electrolytic process for the manufacture of aluminum—the same process that has made it possible to produce the metal at a price where it can compete successfully with such common commercial metals as iron (and steel), copper, lead, zinc, and nickel. Thus aluminum, virtually a laboratory curiosity up to that time, was re-born. So far as you and I are concerned, it might just as well never have existed prior to that February day.

Progress made during the ensuing years has already been chronicled in two comparatively recent *Factory* articles*; the beginning of a second 50 years would therefore seem an appropriate time to take up where they left off and bring plant operating men up to date.

*"Aluminum Arrives," by Lewis K. Urquhart, in *Factory*, Aug., 1934, p. 341; Sept., 1934, p. 387.

Major tonnage of aluminum, now as when those two articles were written, is consumed in the various fields of transportation. Aluminum is the great weight-saver, hence it is not surprising to find that applications in truck and bus construction have increased tremendously. Economies in truck operation, due to weight saved and correspondingly increased pay loads, could be cited almost without end.

All-Aluminum Trains

Two years ago this very month, the streamlined, articulated train was brand-new. First railroad to build one was Union Pacific. It was all-aluminum. U.P. has since added a second—the one that made the record-breaking transcontinental run in October, 1934.

Fully equipped, this train weighed only 210 tons, approximately 500 less than a train of similar capacity but of orthodox design and built of the heavier metals. On one stretch it averaged 120 m.p.h. for two miles; on the run from Cheyenne to Omaha (508 mi.), a speed of 84 m.p.h. was maintained.

In no sense of the word was this a stunt run. No elaborate preparations were made to insure a record. The trip simply demonstrated what may be expected of transcontinental railroading within the very near future. That U.P., at least, looks to aluminum to help it meet that demand is indicated by its present plans to put two aluminum trains on the Los Angeles-Chicago run, two on the Denver-Chicago run.

Which is not to imply that U.P. alone puts its trust in aluminum. Other all-aluminum trains put into service this past year are New Haven's "Comet," a 3-car articulated train which is on the Boston to Providence run, and the Baltimore & Ohio 8-car train which is streamlined but not articulated.

We may skip over aluminum's well-known progress in aircraft construction. Here its light weight makes it the logical material, and the degree to which it has been accepted is illustrated by the fact that practically all the ships now being built in this country are all-aluminum.

Turning briefly to marine transportation, we find that a number of disastrous fires have focused attention on the need to use fire-resisting and fire-retardant materials. In the "Normandie," for instance, aluminum partitions are used.

Other well-known uses of aluminum that we need mention here only in passing are such familiar ones as for cooking utensils and

household appliances, and for electrical conductors. Applications in these fields today are commercial rather than developmental in their nature, and new uses cited would necessarily be additional installations, not new applications.

We must pause somewhat longer in two of aluminum's newer fields of application — architecture and interior decoration. Aluminum spandrels, window frames and sills, doors and door jambs, and a number of other items have been in use for a good many years in present-day buildings, hence their application to home construction in 1936 and from then on may not be strictly classified as new. However, the possibilities are so limitless that this field may be regarded as practically a virgin one. As in marine construction, the need for fire-resistant materials is becoming more and more pronounced, so in the decade before us we may find aluminum taking its biggest forward strides in this particular direction.

In the construction of houses of moderate size, the initial cost of building materials has much to do with their final selection. It is, of course, the lasting quality of aluminum that accounts for its continued progress in the construction field during the past few years, and it is that same lasting quality that will account for progress in the years to come.

Just as an example, take aluminum doors. Let's say it will take a little educating to get people generally to accept them in place of the wooden doors they are so accustomed to. On the other hand, the aluminum door will never warp or stick. It is light in weight and easily operated. It may be cast, formed, or fabricated from extruded shapes or tubing.

Next, Colored Aluminum

Well, we are not trying to sell aluminum doors, but merely want to point out the possibilities for additional commercial applications of aluminum. What has been said of doors might just as well have been said of, say, shower-bath partitions. Those made of aluminum are rust-proof, impervious to moisture, pleasing in appearance, and sanitary. They are easily painted or lacquered to harmonize with the bathroom color scheme.

Color, incidentally, calls to mind one of the newest aluminum developments—the use of the anodic treatment for architectural details, borrowed from the aircraft field. Briefly, anodizing consists of electrolytically oxidizing the metal to secure an extremely hard surface that will not stain or tarnish. As to the color just mentioned, it has been found that the oxidized surface of anodized aluminum can be impregnated with organic dyes and mineral pigments, thus making colored aluminum possible.

The introduction of color lays the fields of architecture and interior decoration wide open. Eventually we may find that you can have that door we've just been talking about in your wife's favorite color—in a color that is "built in," you might say, and will not have to be renewed every few years.

A Versatile Metal

No article on aluminum is complete without a fleeting reference to aluminum paint. Its advantages are well known. Not so well known is the fact that within the year the pigment has been made available in paste form which dries to a smoother finish and is more conveniently mixed than the powder.

No article on aluminum that is confined to two scant pages can, for that matter, hope to be complete. It has been possible here merely to skim the surface. Enough has been set down, however, to indicate that aluminum's phenomenal rise in the space of 50 years cannot be attributed to any ten-strike it has made in one particular industry or branch of industry. If any metal is versatile, it is aluminum.

A BATTERY of eight 204-bbl. aluminum tanks (opposite page) at Victor Brewing Company, Jeannette, Pa.

•

ATTENTION has recently been focused on the need for using fire-resistant materials aboard passenger vessels. This stateroom is equipped with aluminum partition bulkheads and aluminum furniture

You want to know

and the editors will gladly tell you more about the things mentioned on this page

• IF YOU'RE LOOKING for information on company thrift and investment plans, there's a new survey that covers industrial relations policies in 2,452 business establishments. (2601)

• CEMENT of the plastic insulating variety, just announced, is designed for temperatures up to 2,000 deg. F., will stick to any clean surface. (2602)

• WHAT A PAINT should be, what paint does to light, a graphic painting maintenance guide, 18 check points on painting for profit—those are some of the things found in a new paint catalog that ought to reach every maintenance engineer's desk. (2603)

• GLASS, new, can be used for skillets, frying pans, other on-top-of-the-stove pots. (2604)

• MICROSCOPE, 60-power, is specially designed for inspectors and toolmakers. (2605)

• BOOK OF THE MONTH, if you want our opinion, is "A Rubber Plantation in New Jersey." It's the exciting story of synthetic rubber. (2606)

• ASPHALT SHINGLES coated with cement come in permanent colors that could not be had heretofore; are more rigid, hence a greater portion of each shingle butt can be exposed. (2607)

• PAPER CUPS for paint hold a quart, provide maximum economy and convenience in finishing rooms where there are frequent changes in color or material. (2608)

• ACCOUNTING for plant and equipment is the title of a free report that summarizes experience and practices of 46 companies in diversified lines of business. (2609)

• CORE-MOLD sprayer gets into corners and covers surfaces that can't be reached by brush, saves coating material and time. (2610)

• FIRE EXTINGUISHER — there's one that does not freeze even at 40 below. (2611)

• COLOR MATCHING is simpler with a recording photoelectric spectrophotometer that's just out. (2612)

• RETRACTOR increases speed and accuracy of typists, they say. It's a foot-controlled device for retracting the typewriter carriage. (2613)

• FOREMEN, apprentices, disabled workers—how other companies train them is outlined in a study just off the press. (2614)

• GUIDES to selection of nickel alloy steels and nickel cast irons. If you didn't get yours when first announced, it's not too late. (2615)

• CROSS-PLY corrugated cardboard, according to unbiased tests, makes stronger shipping containers. (2616)

• FACE BRICK honeycombed with oblong perforations weighs one-third less than standard brick, meets engineering strength requirements. (2620)

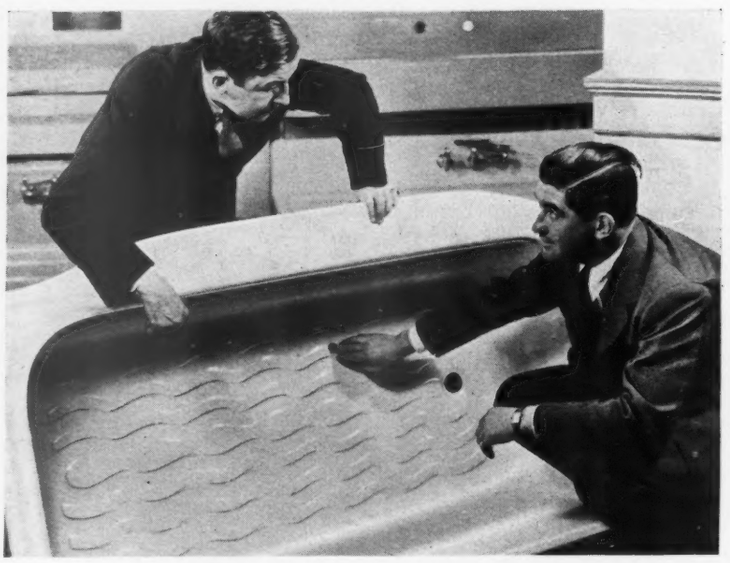
• CUTTING OIL can now be had with sulphur in it. According to its sponsors, it increases its viscosity as its temperature rises, thus permits higher cutting speeds. (2621)

• MAGNETIC DETECTOR, more sensitive than equipment previously used for the purpose, helps you locate pipe lines in case you've forgotten where you laid them. (2622)

• FOR LIGHTING applications involving accurate color differentiation, critical inspection, or difficult visual problems, a new circular mercury-incandescent unit is recommended. (2623)

• FUSE PLUGS with all-white insides and black links can be easily spotted when they blow. (2624)

• FOR LOW BAYS there's a new reflector designed for use with high-intensity mercury-vapor lamps. It provides even distribution of light, no glare. (2625)



Example of how a strictly utilitarian product like a bathtub can be improved. The serpentine embossed bottom is designed to reduce the hazard of slipping. Tub is cast steel. Yes, that's Mickey Cochrane. (2629)

• RE-USE CONTAINER of the month, so far as we're concerned, is the amber-yellow crock with the cheese spread in it. (2617)

• IMPACT STRENGTH and friction resistance—a phenolic molding compound offers them in combination. Suitable for cam parts, builders' hardware, car-door bumper plates, etc. (2618)

• MOTION STUDY—prevailing practices in manufacturing organizations summarized in current report. (2619)

• LEAD is one of our most dangerous dusts. There's a new respirator that weighs only 5¼ oz. (2626)

• BOLT, stainless steel. Subjected for eight years to a severe sulphurous atmospheric condition which caused carbon steel bolts to go to pieces in a short time, it was removed and found as good as new. (2627)

• ONE PART of mercury vapor in a hundred million parts of air can be detected and registered by an instrument just announced. (2628)

Filing Maintenance Data

W. D. HESSERT
and
R. M. MATSON
International Business Machines Corporation, Endicott, N. Y.

★

No ordinary filing system will do for things like drawings, specifications, material lists, and all the other assorted data that the maintenance department must be able to lay its hands on at a moment's notice. Hence this readily understandable classification plan with its six-part numbers that tell all

★

THE PROBLEM of keeping varied records in the plant engineer's office led to the development of this system of filing miscellaneous information turned over to the plant engineer. Information, in this case, consists of drawings, specifications, material lists, and other data on new construction, new equipment, maintenance of existing buildings and equipment, power generation, power distribution, and all other activities of a comprehensive engineering department.

Work, it was decided, falls in either of two broad classifications—it is contemplated work, or it is a job undertaken, ready to be carried out. Different systems of numerical identification were worked out for each class, the first extremely simple.

Work merely in the project stage is assigned an ordinary number. Numbers follow in sequence with no attempt to indicate the nature of the job. Drawings are marked P-1, P-2, and so on to conform to the number assigned.

Upon decision to carry a project through, a more complicated but readily understandable system of classification is employed. A six-part number is assigned and noted in six panel spaces on the various forms to be used. Each panel tells a different story about the material numbered, and the six panels together definitely locate the position of the material in the files.

Why So Exacting a Plan?

Need for a system of this sort can be understood when it is explained that we keep all architectural plans and details; electrical, mechanical, and structural drawings; machine layouts; machine parts; and so on in a single file. With a plant covering many acres, including about 30 buildings of one or more floors, and separate departments scattered among several buildings or parts of buildings, there must be a system as exacting as this.

The first panel of the number contains a letter, the various letters representing different standard-size drawing sheets.

After the sheet size has been fixed, the most important item to know about a drawing is with what building it is connected. Then we are ready to assign the second number in the six-panel space. This is the building number.

The next item of importance is the floor on which the work is to be done, the floor number being assigned to the third panel.

As a great deal of the work is definitely related to a certain department, the department number is placed in the fourth panel.

The fifth panel requires a bit more explanation. The number here indicates the nature of the job. As a pattern, we employed the method developed by the American Institute of Architects, based on the Dewey-decimal system, for classifying and filing catalogs according to trade or class of work.

Under this system there are forty of these general classifications, each having a number assigned to it. As an example, "4" has to do with concrete, various subdivisions under it covering mixing, placing, or forming; "31" covers electrical work and, incidentally, is the most completely subdivided.

For our case the classifications were not complete in several instances but were flexible enough to be expanded to meet the requirements. Chief change was the addition of a new classification to cover surveys of land, departmental floor space, appraisals, etc. This type of work was given the next consecutive number in the A.I.A. system, or "41."

Classifications for Machines

Since the A.I.A. classifications pertain to buildings only, we had to add classifications for many types of machines. These classifications were of necessity much more finely drawn than the subheadings fitting an architect's requirements, but by the decimal system of subdivision it was possible to extend this portion of the file to meet the particular conditions.

The sixth panel is merely a serial number, which is other than "1" when the first five panels are identical for several documents.

The resulting number is now something like this:

A-28-3-34-31-1

In glancing at this number, one can, when acquainted with the filing system, learn:

1. The drawing is on a sheet 8½x11 in.
2. It has to do with building 28.
3. It refers to the third floor of the building.
4. It is part of department 34.
5. The class of work is electrical.
6. It is the first in the series.

It is impossible to assign a definite number to all panels at all times. For example, the drawing may be a plot plan showing all the buildings, a sewer layout, or a landscaping plan. In this case, where there is no particular building, or where many buildings are involved, the

building panel would contain an 0.

Similarly, the elevation may not have to do with any one floor, but all floors. A section through an elevator shaft, for instance, shows many floors. In such case the 0 is placed in the floor panel.

Many drawings have no reference to a department; such might be a general floor plan. Again, a general floor plan has many classes of work shown on it, and the 0 must be used in the fifth panel. As there is always a first drawing in the series, the 0 never occurs in the sixth panel.

The following are some examples of the use of the 0:

Drawing number A-0-0-0-0-1 has nothing to tie it up with a particular building or floor, is not for any departmental use, and is of general classification and the first of a series. It happens to be the factory seal. Drawing number B-0-0-0-41-2 is made on a B-size sheet, is general for building, floor, and department, but is the second in the series of surveys.

If Departments Move

Drawing number A-0-0-34-35-1 deserves a bit more of an explanation. It involves a department which is likely to be moved at any time; therefore building and floor must be designated as general. This drawing then becomes one that is definitely tied to a department, regardless of the department's location. In this case, paper size is A, building and floor are general, but the job would move with department 34 were it moved to another building or floor. Job classification is 35 (equipment); it is first of the series, and happens to be the setting plan for a machine.

Is it possible to have a drawing assigned to a floor but not to a building? Yes. For example, there exists a plan of the first floors of all buildings in their relation to each other, also second floors, and so on. On one drawing (C-0-2-0-0-1) is shown all departmental boundaries.

Card File

Referring again to the first panel of the number, only those drawings made by the corporation are assigned a standard sheet size. These are designated by letters from A to E. For each drawing there is made a card bearing the same number as the drawing, with other pertinent information. These cards are then filed according to the first panel, or letter, and then in order of the second, third, etc., panels. This card file is consulted when numbering a new drawing, to ascertain the next serial number to be used. And general information is usually sought from the cards rather than from the drawings.

In any large organization there are many drawings received from outside sources. Such drawings will all be assigned numbers in this system, in exactly the same manner as drawings made in the plant engineer's office, only the first panel

(Continued on advertising page 46)

REVISIONS

A	Add Door Sizes, Plumbing Fixtures & Elect Outlets Revise Stair Location

ISSUED TO	No	DATE SENT	ORDER No	ISSUED TO	No	DATE SENT	ORDER No
Field	2	7 20 33	640				
Est Dept	1	7 20 33	641				
Engineer	1	7 20 33	642				
REVISION "A" 10-2-33							
Field	2	10 2 33	702				
Est Dept	1	10 2 33	703				
Ins Co	1	10 9 33	732				
N Y State	1	10 16 33	748				

BUILDING No 29
BOILER HOUSE
GROUND & FIRST FLOOR PLANS
SCALE 1/4" = 1'-0"

INTERNATIONAL BUSINESS MACHINES CORPORATION
OFFICE OF THE PLANT ENGINEER
ENDICOTT NEW YORK

DATE 7-20-33 | DRAWN BY WBT

APPROVED BY John Sr Dennard PLANT ENG

REVISION DATES

A 10-2-33	F	K	P
B	G	L	Q
C	H	M	R
D	I	N	S
E	J	O	T

MATERIALS

Brick
Cinder Block
Concrete

DRAWING NUMBER

C 29 1 0 0 1

FIGURE 1. All company drawings carry a legend in this style

C 29 1 0 0 1

BOILER HOUSE - BUILDING No 29
GROUND & FIRST FLOOR PLANS
SCALE 1/4" = 1'-0"
DATE MADE 7-20-33

FIGURE 2. File card for drawing shown in Figure 1. This file is kept to maintain sequence of serial numbers, shown in last panel

G 29 0 0 34 2

ASH HOPPER & GATES
ALLEN SHERMAN HOFF

Dwg No 1204-2

TITLE	MANUFACTURER'S DRAWING
ASH HOPPER & GATES	1204-2
MANUFACTURER	I.B.M. DRAWING No
ALLEN, SHERMAN, HOFF	G-29-0-0-34-2

RECEIVED		SENT TO			RECEIVED FROM			RETURNED TO MFGR.		
No	DATE	No	DATE		No	DATE		No	DATE	REMARKS
4	11-3-33	4	ENGINEER 11-3-33		3	ENGINEER 11-7-33		2	11 8 33	DISAPPROVED
2	11-10-33	DESTROYED			SUPERCEDED			DO		BY PRINTS OF 11-16 33
3	11-16-33							3	11-17-33	APP. AS NOTED
	11 22 33	4	ENGINEER 11-22-33		3	ENGINEER 11-27-33		2	11-28 33	APPROVED.

FIGURE 3. When drawings of outside manufacturers are filed, the usual file card is made out. In addition, a card to be filed under manufacturer's name is prepared

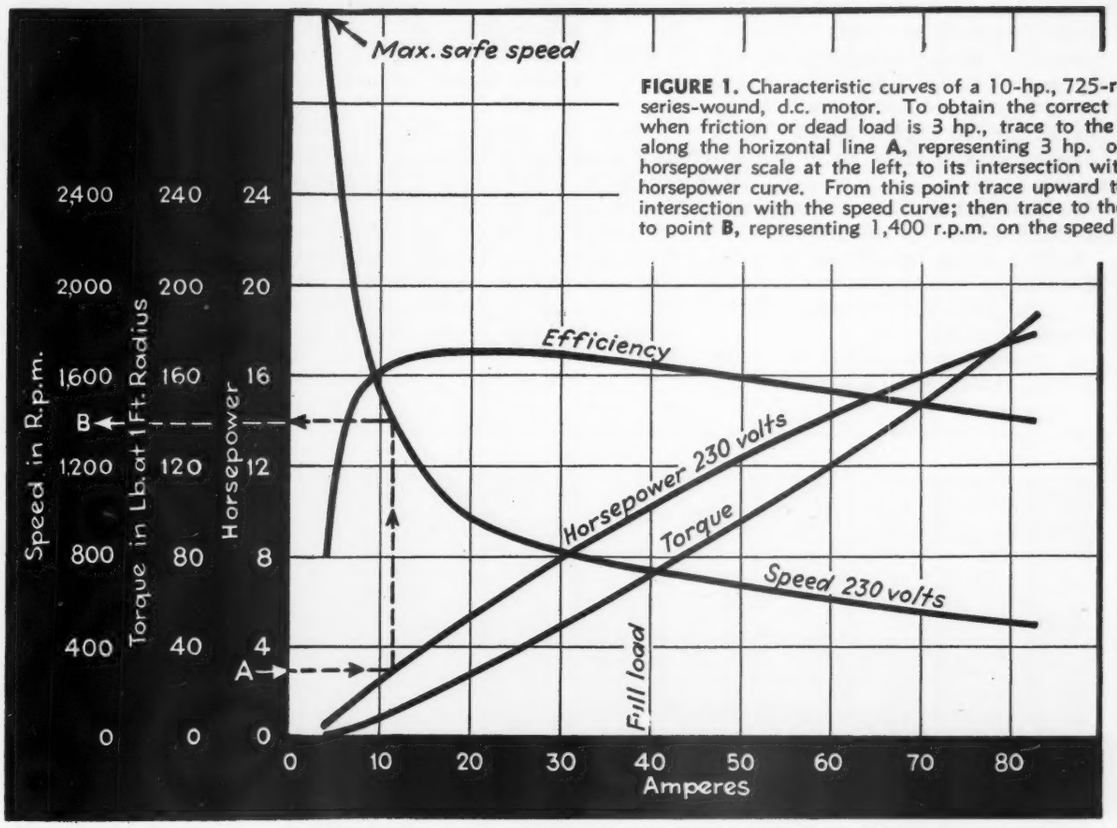


FIGURE 1. Characteristic curves of a 10-hp., 725-r.p.m., series-wound, d.c. motor. To obtain the correct speed when friction or dead load is 3 hp., trace to the right along the horizontal line **A**, representing 3 hp. on the horsepower scale at the left, to its intersection with the horsepower curve. From this point trace upward to the intersection with the speed curve; then trace to the left to point **B**, representing 1,400 r.p.m. on the speed scale

Gearing Series Motors

On fast-duty cycles a motor that is actually plenty big enough to do the job may operate unsatisfactorily, may even burn out—all because the ratio of reduction between motor and driven shaft is wrong. The trick is to let the motor get up enough speed to keep the current down

★

R. F. EMERSON
Industrial Engineering Department
General Electric Company
Schenectady, N. Y.

SPEED-TORQUE characteristics of the d.c., series-wound motor make it particularly suitable for many industrial drives. It is invariably applied to the hoist, bridge, and trolley motions of cranes used in plants operating on direct current, and is used for many other variable-speed drives where the motor can be coupled, geared, or connected by a chain to the load. If the load is removed from a series motor, its speed will mount to runaway proportions.

Where series motors have been applied to high-inertia drives by the plant engineering force, trouble due to ignorance of series motor characteristics has sometimes resulted. It is particularly likely to occur when the motor is geared to a high-inertia load, such as a transfer car, where the dead load* is a small proportion of the motor rating, and the car or drive makes a large number of short runs. If long runs are to be made, the motor should be geared for a relatively high running speed. However, when the travel or running period is short and the cycle is repeated frequently, the motor may spend most of its operating time running at very low speed. In other words, power is cut off and the motor stopped before it has reached its geared speed.

Every motor must run fast enough to generate sufficient counter-emf. to reduce its current intake to reasonable proportions. If its speed is always held down to some low value, the motor draws a very high current and the I^2R heating effect will, in extreme cases, have disastrous results.

The fact that the speed of a series

*By "dead load" is meant the load imposed on the motor by friction, windage, gravity, and so on, when the car travels at a constant rate of speed. It is exclusive of the inertia load due to accelerating the mass from rest, or from some low speed to a higher speed.

motor varies with the load does not always seem to be taken into consideration when the gear ratio is selected. Trouble with series motor drives is often caused by their being geared for too high a speed. These troubles usually show up in the following ways:

1. The motor fails to accelerate the load as fast as was expected.
2. The motor spends all its time accelerating and decelerating.
3. The drive fails to make the required schedule.
4. Motors show signs of overheating and in some cases burn out.

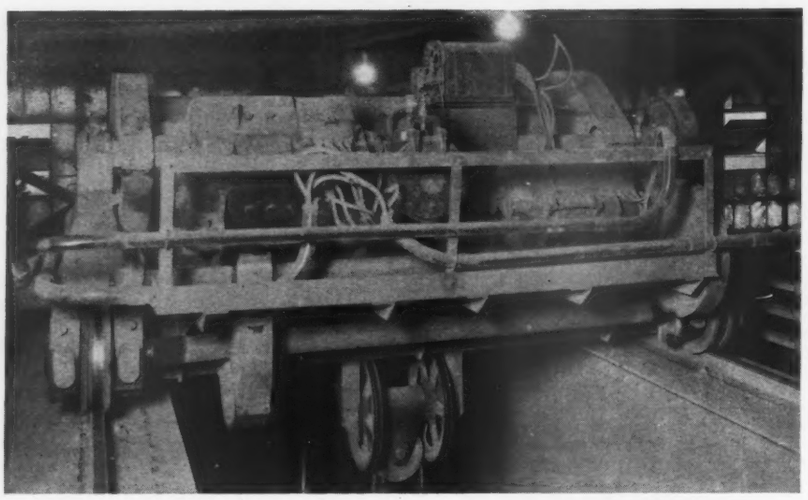


FIGURE 2. The series-wound, mill-type motor driving this crane trolley is rated 33 hp. Although the trolley carriage has less mass than the bridge it is usually geared for a higher free-running speed, which increases the inertia load at the motor pinion

Let's take a practical example. Figure 1 shows the speed-torque curves of a 10-hp., 725-r.p.m., series-wound, crane-type motor, two of which are to be used for driving a transfer car having these characteristics:

Weight	17 tons
Car wheel diameter	18 in.
Car speed	500 f.p.m.
Number of axles per car	2
Number of driving motors per car	2

To travel at 500 f.p.m., the motors should be geared or chain-connected to the car axles so that each axle will turn at $500 \div (3.141 \times 1.5) = 106$ r.p.m. The power required to propel the car at the desired speed of 500 f.p.m. is:

$(17 \times 20 \times 500) \div (33{,}000 \times 0.85) =$ 6 hp. where

20 = force in pounds per ton weight of car necessary to propel it at constant speed

33,000 = foot-lb. per minute per horsepower

0.85 = efficiency of the drive between motor pinion and car axle.

Since two motors will be used, each must deliver 3 hp. From the curves in Figure 1 it is found that the motor speed compared to 3 hp. for propelling the car is 1,400 r.p.m.; the current is 11.7 amp.; and motor torque is 11.5 lb. The correct gear ratio is found by dividing the motor speed of 1,400 r.p.m. by the car wheel speed of 106 r.p.m., or $1{,}400 \div 106 = 13.2$ to 1. The first column of the table shows these values.

If, instead of first determining the actual dead load of the car, the gear ratio is selected by dividing the rated motor speed of 725 r.p.m. by the car wheel speed of 106 r.p.m., the gear ratio is found to be 6.8 to 1 instead of 13.2 to 1. In the second column of the table the operating characteristics of the same motors are tabulated on the basis of a 6.8-to-1 gear ratio.

Although the gear ratio is different, the tractive effort and torque at the car wheel will be the same. With the same values used in the previous calculations, it is found that the torque at the car axle is $(8.5 \times 20 \times 18) \div (2 \times 12) = 128$ lb., where

8.5 = weight of car, tons per motor

20 = force in pounds per ton weight of car required to drive it at constant speed.

Since the gear ratio is to be 6.8 to 1, the torque at the motor shaft is $128 \div (6.8 \times 0.85) = 22.1$ lb. at 1-ft. radius.

Referring again to the curves in Figure 1, the corresponding values for motor speed, amperes, and so on can be found. Since the motor speed is now found to be 1,060 r.p.m., the car wheel speed must be $1060 \div 6.8 = 156$ r.p.m. The wheel diameter is 1.5 ft.; so the car speed will be $3.1416 \times 1.5 \times 156$ or 735 f.p.m. In other words, the gearing selected does not give the expected car speed, but a speed nearly 50 per cent greater.

If the data in the table are analyzed, a number of important points will be noted which materially affect the motor operation.

It Makes Lots of Difference

Since with the 6.8-to-1 speed ratio the motor torque is nearly twice as great as with the proper gearing of 13.2 to 1, there is less torque available for acceleration. Full-load torque of this motor is $(10 \times 5{,}250) \div 725 = 72.4$ lb. During acceleration periods the motor may be called upon to exert an average of, say, 175 per cent of its full-load torque, or 127 lb. torque. For the 6.8-to-1 speed ratio there is $127 - 22.2 = 104.8$ lb. torque available for acceleration while the operator is manipulating the controller, as compared with $127 - 11.5 = 115.5$ lb. with the correct, 13.2-to-1, ratio.

This means that the car cannot accelerate so fast with the 6.8-to-1 ratio and, more important still, the acceleration current peak does not reach the free-running speed value until the car speed is 737 f.p.m., as compared to 400 f.p.m. with the 13.2-to-1 ratio. Where transfer cars, for example, make short runs, the car speed will barely reach 500 f.p.m. before it is time to bring the car to rest again.

From Figure 1 it is found that 127 lb. acceleration torque corresponds to 62 amp. With the correct, 13-2-to-1, ratio the current is reduced from 62 amp. to 11.7 amp. for

(Continued on advertising page 44)

How Change in Gear Ratio Affects Operation of Series-Wound Motor

Gear Ratio	13.2 to 1	6.8 to 1
Horsepower	3.0	4.4
Motor Torque	11.5	22.2
Motor Speed, R.p.m.	1,400.0	1,060.0
Current, Amp	11.7	16.5
Torque at Car Wheel	22.2	22.2
Car Wheel Speed, R.p.m.	106.0	156.0
Car Speed, F.p.m.	500.0	737.0

Induction Motor Maintenance

1. SLIPRINGS AND BRUSHES

LIONEL A. HUNT
Service Engineer
Bepco Canada Limited, Toronto, Canada

SO YOU'RE TOO SMALL, are you, to bother about inspecting motors regularly? Involves too much paperwork, does it? No plant is too small to do a "big plant" job of motor maintenance. No plant is too small to shrink from the small amount of paperwork it takes. You'll lessen the chance of costly shutdown if you follow the procedure outlined in this and succeeding articles

★

IT IS just as important to guard against motor trouble and shutdowns in the small plant as in the large one. The only way to do that is to establish an adequate inspection routine and record system.

More or less elaborate systems may be required for keeping records of inspection in large plants, but the smallest will find it well worth while to keep some record. A form that is suitable under most conditions is shown in Figure 1. It may be made up as a white print or a typewritten form. With some such form as a guide the inspector can work systematically and thus reduce the chances of omitting any item requiring attention.

Generally speaking, a monthly inspection seems to work out very satisfactorily. The item that requires the most attention is oiling, but it will be found that, except in unusual cases such as high ambient temperatures, filling up oil wells of ring-oiled motors monthly is sufficient. From the monthly inspection record it is a simple matter to determine when to renew a bearing, since a gradually decreasing air gap is readily noted, and the amount of wear likely to occur during the next month can be estimated.

The record also reveals when to change starter contacts; when trouble is imminent in windings; and so on. A motor inspector should be provided with a set of air gap feelers, a portable, clip-on ammeter, an insulation resistance meter, a flashlight, a pocket mirror (the latter is invaluable when inspecting oil rings in motors located in awkward places), and a voltage tester.

Inspection and maintenance go hand in hand, of course, and periodic inspections will reveal from time to time that certain maintenance is required. With a.c. induction motors, troubles or conditions calling for maintenance come under four general divisions — sliprings and brushes, bearings, stator windings, and rotor windings. Although the slipring or phase-wound motor is not in such wide use as the squirrel-cage type, most plants boast at least one, and it is this type that will be dealt with first.

Sliprings and Brushes

The slipring motor is used instead of the squirrel-cage where speed variation is required, or where starting currents must be limited to low values. These motors usually have

MOTOR INSPECTION REPORT

It is recommended that the following work be attended to immediately:-

DATE INSP'T'D: DEC. 18 — PLANT SLACK PERIODS: WED. AFTERNOON
BY: T.H.

Replace F.E. bearing & clean winding 20 HP Snagging Dept.
Order new set contacts 25 HP Compensator Mach. Shop

Motor H.P.	Volts	R.P.M.	Pulley Size	Load Driven and Location	Control and its Condition	Motor Condition: Bearings Front	Bearings Pulley	Air Gap	Winding	Full Load Amps. per T. A	B	C	No Load Amps	Remarks
40	550	900	12x10	Blower main cupola	Drum O.K.	O.K.	O.K.	0.025	O.K.	38	36	36	13	
15	550	1200	8x8	Main line shaft	Magnetic switch O.K.	O.K.	O.K.	0.018	oily	12	12	12	10	
20	550	1800	10x8	Snagging Dep't	Compensator O.K.	O.K.	Bad	0.010	Oily & grit	Fluctuats 23	23	23	12	Grit in bearing megger 80,000 ohms
25	550	1200	10x12	Mach. shop	Compensator O.K. See remarks	O.K.	O.K.	0.020	O.K.	18	18	18	10	Order new set contacts
9	550	720	Solid Coup	Hoist	Reversing drum	O.K.	O.K.	0.015	O.K.	up & to	8	8	Burn	Renew carbon arcing tips on control
1	550	3600		Grinder	Snap switch	Hot	Hot	?		-	-	-		Totally enclosed

The following work to be done at next inspection:-
Install contacts 25 hp. compensator mach. shop
Install arcing tips elevator control

Parts required
Contacts 25 hp. comp. mach. shop
Arcing tips for hoist control (in stock)

Tom Heatley
INSPECTOR

FIGURE 1. With this report form the motor inspector can't forget important items, and the office has a permanent record of his findings

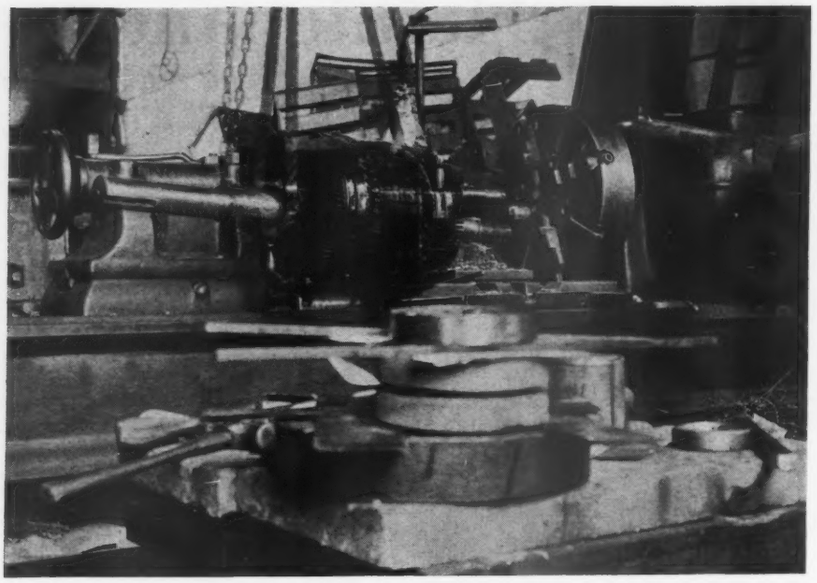


FIGURE 2. Two new rings have been shrunk on over the old ones, and spacing bars put in place to insure proper positioning of the third ring

continuously rated sliprings, although some have lightweight rings fitted with a manually operated short-circuiting device that is closed when the rotor is up to speed. This arrangement saves wear on brushes and rings, but care should be taken that the motor is never thrown on the line with the device closed. Brushes on slipring motors are designed for heavy currents; so any odd brushes that happen to be available should not be used. When brushes are replaced the new ones should have the same characteristics as those originally supplied by the manufacturer.

A Reason for Ring Wear

Slipring brushes usually have low specific resistance, high-carrying capacity, ranging from 100 to 150 amp. per sq.in., and low contact drop. Peripheral speed of the rings in feet per minute should also be considered; the incorrect type or grade of brush may heat up or cause undue wear of the sliprings. The width of the brush is the measurement coinciding with the width of the slipring face, and when ordering brushes the measurements should be given in the order of length, width, and thickness, even though the width may exceed the length, or the thickness exceed the width.

Brush pressure should be adjusted with a spring balance and for sliprings should be about 3 lb. per sq.in. of contact area—not 3 lb. per brush. Brushes should be checked at each inspection to make sure that they are free in the holders. A short run with a brush that is in poor contact with a ring may badly pit or burn it.

When rings wear excessively there is always some cause for it. For example, the brushes may not be of the proper grade; the tension may be too high or too low; brushes may be tight in the boxes; rings may be eccentric; or there may be excessive vibration of the rotor. If the brushes are seen to rise and fall as the rotor comes up to speed, the rings are eccentric and should be trued up.

It is easy to true the rings of small rotors in the lathe, but with large ones it may be necessary to mount the cutting or grinding equipment on the motor, unless the ring assembly can be drawn from the shaft and turned on an arbor. When doing the job in place it is usual to fit and clamp a suitable plate to the motor frame or endbell close to the rings, and to arrange a lathe compound rest on this plate so that the feed will move the tool across the rings.

Better to Grind Than Cut

Unless the rings are in really bad condition it is better to grind them than to cut them with a tool, since it is difficult to get a sufficiently rigid mounting to avoid chatter. For the same reason it is more satisfactory to use a stationary carborundum block or commutator stone than a toolpost grinder. The rectangular stone is clamped across the tool rest, in contact with the high side of the ring. After the stone has been passed three or four times across the rotating ring, the clamping bolts are loosened and the stone is tapped lightly to move it toward the ring, after which further cuts are made.

There are on the market special tool rests for this purpose, with both longitudinal and cross feed. If much work of this kind is to be done, it is advisable to obtain one.

New Tires for Old Rings

If the motor is turned by its own power when grinding the rings, old brushes should be used and afterwards discarded, since the grit imbedded in them may later wear the rings. Whenever the rotor can be driven more slowly from some other source of power, this should be done. For example, it is sometimes possible to back the water through a centrifugal pump and thus obtain a suitable cutting speed.

When rings become very thin it is necessary to replace them. But it is usually inconvenient to shut the motor down long enough to build up a complete new ring assembly. If there is not sufficient time to obtain rings from the manufacturer, it is frequently possible to rebuild them by shrinking on new brass "tires." Without dismantling the motor, measurements are taken of the minimum diameter to which the old rings can be turned in order to allow maximum tire thickness, and the new tires can be cast and turned ready to be applied as soon as the motor can be shut down.

The ring assembly is then drawn from the shaft, mounted on an arbor, and the old rings are turned down for a shrink fit of the new tires, allowing approximately 0.002 in. for each inch of ring diameter. The first tire is heated until the color can be seen to change; then it is dropped over the lower ring of the assembly, which is set up as shown in Figure 2.

Iron bars or other means of spacing should be placed to locate in its proper position the second ring, which is similarly fitted. The third ring should then be shrunk on, the whole assembly tightened up, mounted on an arbor, and the rings trued up on sides and face.

The rotor must, of course, be carefully balanced to eliminate vibration, which would result in ring wear.

Maintenance and replacement of motor bearings will be discussed in a succeeding article to appear in an early issue.

People Who Work In Glass Houses

Are lucky. They don't have to depend upon such uncertain things as infiltration for the air they breathe. New Owens-Illinois laboratory with outside walls and partitions of glass blocks, is a case in point. Air conditioning makes it an ideal place to work in, winter and summer

★

LEONARD CHURCH
Regional Editor, Cleveland

INSTALLATION of complete air conditioning in the new research laboratory of the Owens-Illinois Glass Company at Toledo, Ohio, was prompted by a number of considerations, not the least of which were predicated on the unique glass-brick construction of the building.

About twice the volume of ordinary brick, the glass blocks developed by Owens-Illinois and used in outside walls and all inside partitions of the building are hollow, partially evacuated, translucent units of water-clear glass. Variations in the prismatic patterns or "cuttings" impressed on the inside faces of the blocks control their light-transmitting values and diffusing properties; as much as 86.5 per cent or as little as 11.7 per cent of the light falling upon the blocks can be passed through. To minimize the accumulation of dirt and make its removal easy, the exterior faces of the blocks are either smooth (for walls through which the maximum amount of light is wanted), or have simple, flat ribs (for retarding light or adding decorative effect).

With the glass blocks replacing the windows as well as walls and partitions, ordinary infiltration of air (and dust) has been entirely eliminated as a source of partial ventilation. The air conditioning installation has therefore had to be designed of sufficient capacity to handle completely the requirements of men and materials within the structure.

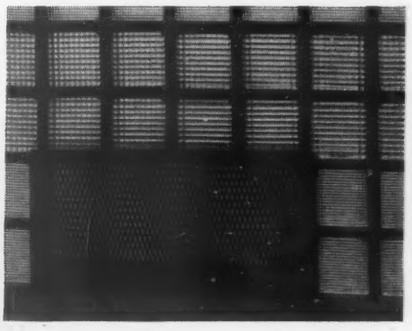
The air distributing system, exclusive of five private offices, is divided into seven zones in which the temperature conditions are controlled during both summer and winter by varying the volume of conditioned air to be admitted.

For the five private offices a separate supply fan is furnished which, under winter operation, takes a mixture of conditioned air at a point ahead of the main supply fan and mixes with it a quantity of filtered outside air to maintain automatically a duct delivery temperature of 68 to 70 deg. F.

The complete equipment has a capacity sufficient to maintain a condition of 83 deg. dry bulb and 50 per cent relative humidity during periods of summer operation when the outside atmosphere does not exceed 95 deg. dry bulb and 78 deg. wet bulb.

Under maximum conditions, the equipment has to handle 26,000 cu.ft. per min., 12,000 of which is fresh and 14,000 recirculated air.

(Continued on advertising page 50)

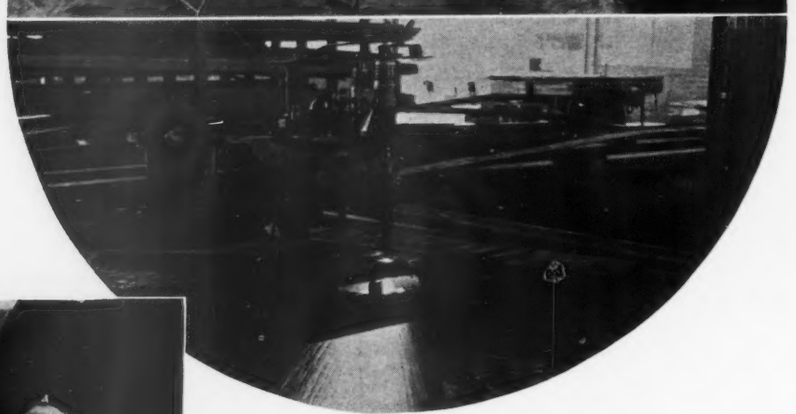


WALL GRILLES at the floor line of the glass block partitions provide equal distribution and easy return of air to air conditioning equipment without draft in the corridors

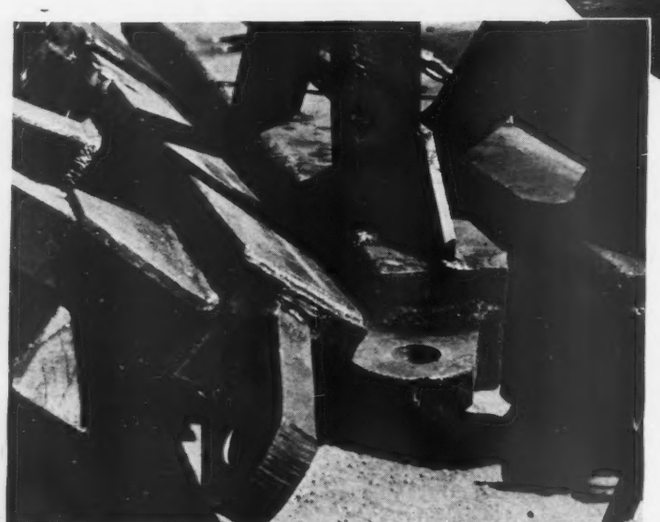
AT THE LEFT is the supply duct that distributes 4,000 cu.ft. of clean air per minute to one section of the Owens-Illinois laboratory. On the extreme right is shown a return duct leading to glass filters and thence to the conditioning equipment. The center duct is one of a series that supply other sections of the building with conditioned air. These ducts will, of course, be concealed when ceiling is completed

FROM FLAT STOCK. Working to a templet, this oxy-acetylene torch makes fast work of cutting any desired shape from stock. Not as fast as a big press perhaps, but there's a difference in die costs and investment

THESE BOX BEAMS, patented by the company, illustrate the structural possibilities of welding. Built from angles by the use of the welding arc. Note anchoring of end bearings, use of box-beam braces, and of braces torch-cut from flat stock



ANOTHER CUTTING JOB. In this machine the templet is bolted into place above and the cutting head automatically follows. An attendant resets the torch after each piece is finished



BUILDING UP THE PUSHER of an "angle dozer." An all-welded construction except for the cutting plate at the bottom, made of hard alloy bolted on for removal when worn. Note use of box beams

He Welds

NO CAST BEARINGS. These bearings are built up from two strips of steel welded together and machined. Note homogeneity of the welds

R. G. LeTOURNEAU got his start in life in a garage repair shop. Handy with the welding torch, people in his home town say he used to weld on his pants buttons. When he got into the dirt-moving business he carried his welding rod with him, and the LeTourneau line of dirt-moving equipment comes close to being a 100 per cent welded job. In the new Peoria factory there is a small battery of machine tools and a sizable parts and materials stockroom. The rest of the floor space is taken up almost completely with jobs being built up, piece by piece, out of sheet metal and steel shapes.

Welding, the company believes, produces a tougher and longer-lived job than can be produced by casting or riveting. Special alloy steels and standard structural steels can be most economically combined to produce the greatest strength, durability, and lightness at the lowest cost. Wearing parts are carburized and heat-treated. Last but not least in equipment that may any day roll down a mountainside and must therefore be able to "take it," repairs may be made in the field easily and quickly by any competent mechanic with a welding torch. That keeps the pay dirt moving.

Sales for the new line crowded the company out of its original Stockton plant into the open, where operations went on until a new plant could be rushed up over them. Incidentally the plant is of welded construction and was hoisted into place with a LeTourneau tractor-mounted derrick. Last summer an eastern plant was built in Peoria and work has again overflowed outdoors.

The line is an innovation not only in its extensive use of welding and cutting torch, but in many other features of design, such as big low-pressure tires, sometimes as many as eight of them abreast on the rear axle, which hold up 30- and 40-yard loads in mud, gumbo, and soft fill. Big soft tires also make operations practicable at faster speeds. There does seem to be business for firms with new ideas in design.

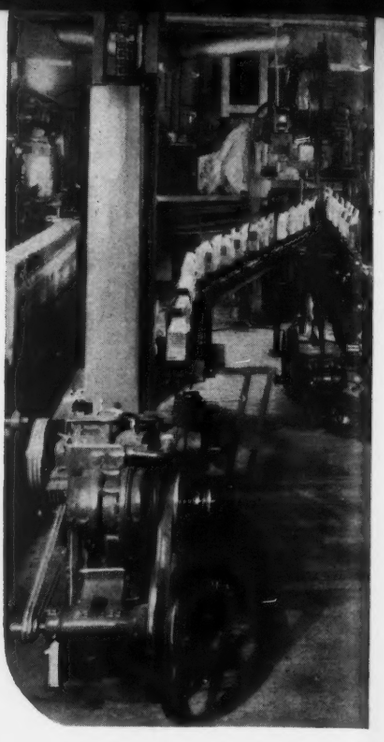
A COMPLETED SCRAPER awaits shipment. A "power unit"—also largely a welded job—controls the placing of cutting edge. The front apron lets down when the scraper bowl is filled and is raised to any desired height to discharge the load

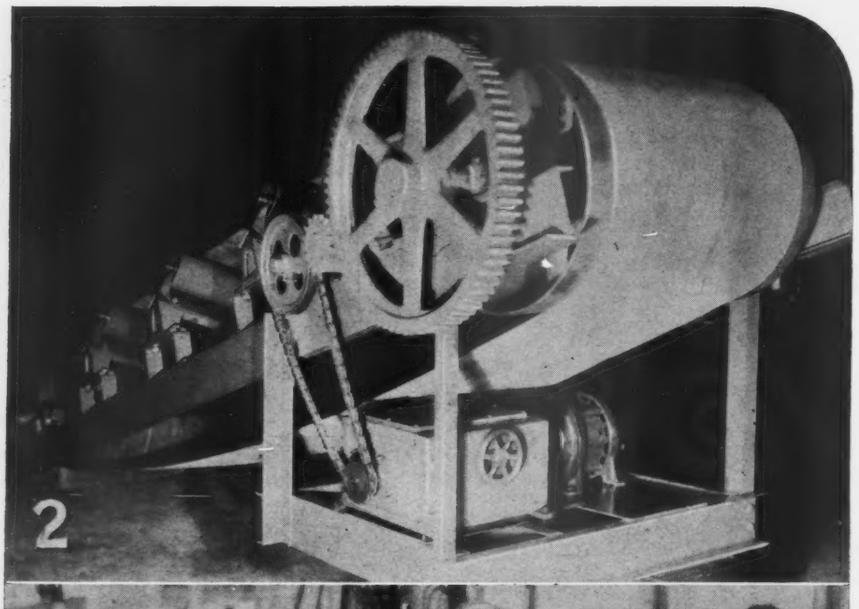
Wherever He Can

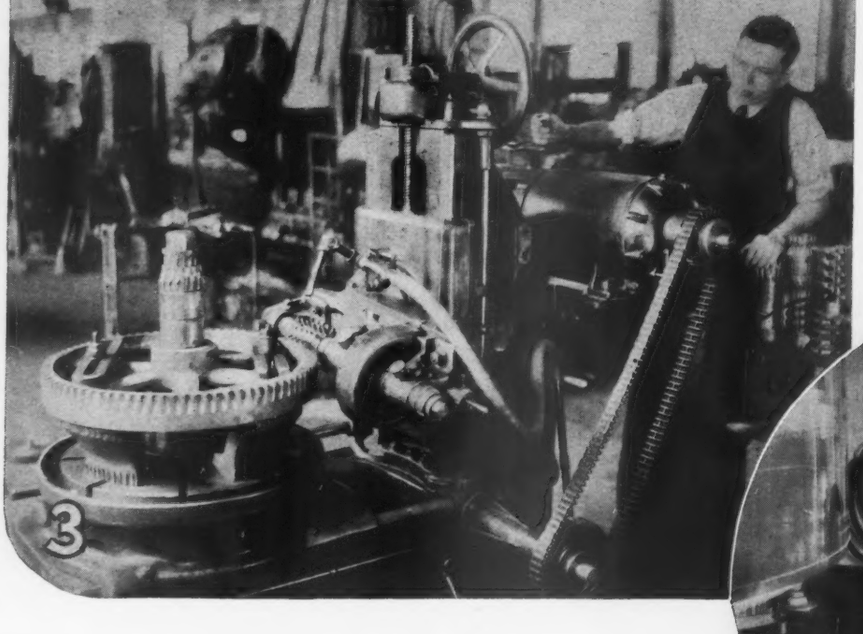
EVEN THE NAMEPLATE is tacked on with the welding rod

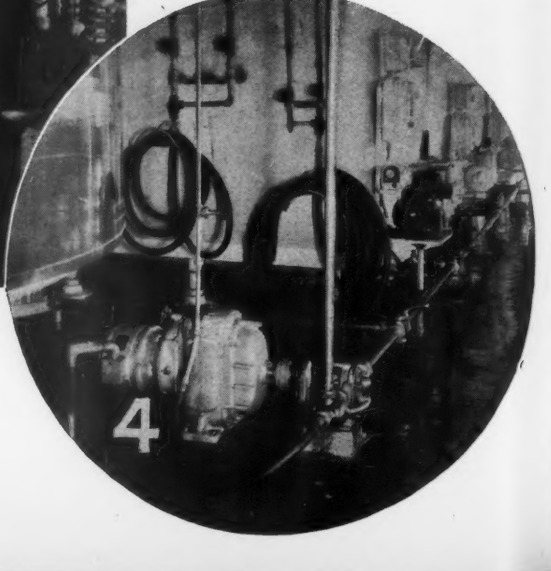
Now Fast, Now Slow

Variable-speed transmissions afford a highly satisfactory and widely used means of obtaining the speed control necessary in many manufacturing operations









1 In the packaging line of a bakery all equipment is synchronized for automatic handling of cartons by means of Reeves Vari-Speed Motor Pulleys. The two motors on the floor drive bottom sealers, while the two in the background operate carton liners.

2 Neither too slow nor too fast: a J.F.S. variable-speed transmission (Stephens-Adamson) drives this belt feeder at exactly the speed required

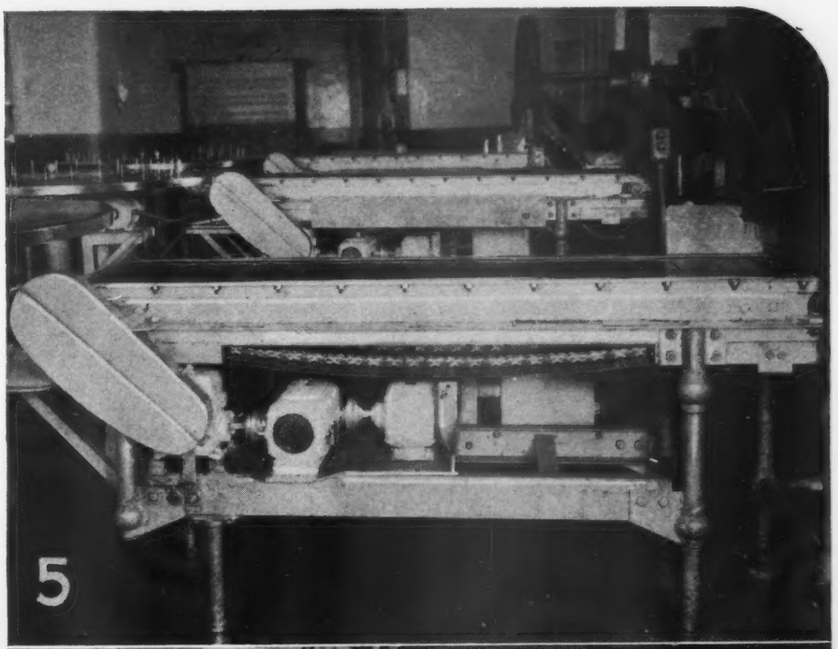
3 A turn of the wheel on the motorized J.F.S. variable-speed transmission is all that is needed to vary the number of cutting strokes per minute of the gear hobber which it drives

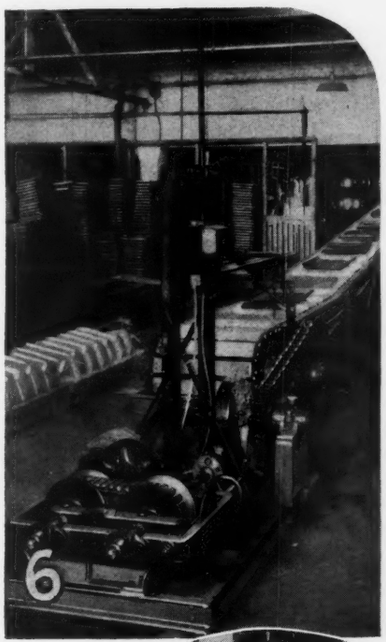
4 One of the milk pumps in a large dairy has to be operated over a speed range of 77.5 to 380 r.p.m.; so it's driven through a motorized, vertical P.I.V. (Link-Belt) variable-speed transmission

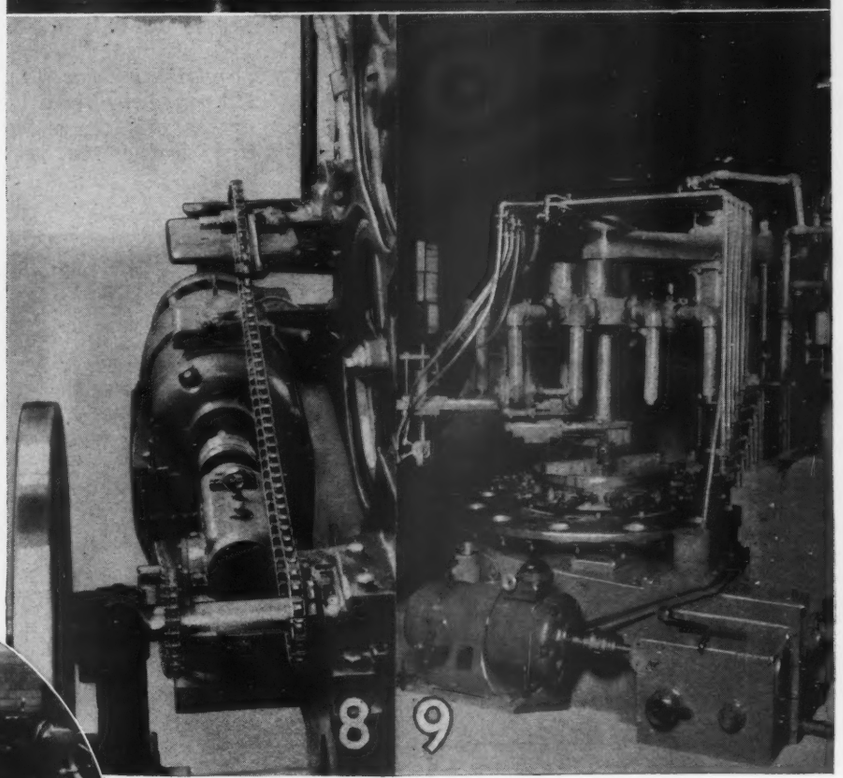
5 Maybe your breakfast bacon traveled over this apron conveyor in the bacon slicing department of a well-known packing plant. It is driven through a Link-Belt variable-roller drive, whose output speed is controlled by a hand wheel

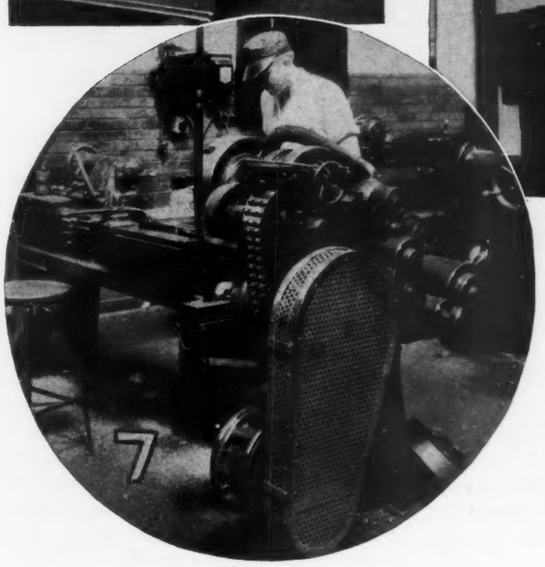
6 A variable-speed transmission (Reeves) controls the speed of a slat conveyor handling enameled parts in a gas stove plant to conform with the production schedule and the size of the parts

7 A 25 per cent increase in the efficiency of this lathe, operating in an automobile plant, is credited to the variable-speed transmission (Reeves) which permits close control of speed over a wide range









8 Transitorq (New Departure) driving a rotary cylinder press enables a printer to get the exact speed required for best results on different types of jobs and different kinds of paper

9 Different speeds required by a glass press for handling a wide variety of shapes and sizes of parts is provided by the Transitorq drive

Operating Shorts

Emergency Heater for Dope Tank

CHARLES JONES, *Senior Electrician Continental Can Company, Jersey City*

A temporary means of heating a dope tank gradually and uniformly was urgently needed to get production started, pending permanent installation of the equipment and purchase of a commercial heating unit suitable for the purpose.

In casting around for some way out of this situation it was recalled that some discarded, old-type mercury vapor lamps had been put in storage. These lamps were designed to operate on 220 volts, a.c. and it was felt that one of the auto-transformers used with each lamp could be made the basis of an induction heater. As shown in the sketch, one of these transformers was cut in half between the two windings, which were on opposite sides of the core. After being cut, the two poles were carefully squared so as to fit snugly against the bottom of the cast-iron dope tank. This precaution was necessary in order to avoid losses due to the extremely high reluctance of air to the magnetic flux. The winding was then connected to a 110-volt source of alternating current.

Results were so satisfactory that we have planned to use this heater permanently.

Mr. Jones's contribution has been awarded the $10 payment offered by the editors for the best Operating Short submitted during the past month.

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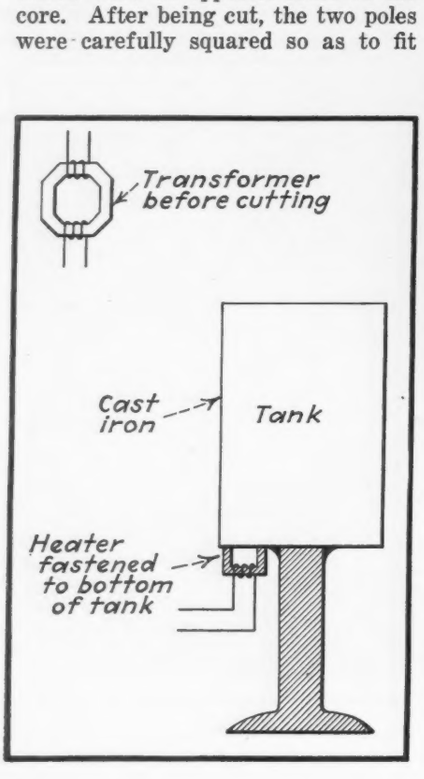

Carload Conveying in Package Lots

SOURCE, *Packard Motor Car Company Detroit*

A prize example of compact, economical handling is that of finished connecting rods at the "One Twenty" plant. The rods go to an inspector, who not only inspects them but also matches them up in sets of eight. He then places the set of rods on a special board, as illustrated, two rods to each pair of pegs on the board. Notice, also, the handholds in the boards, which effectively prevent their being dropped in racking or unracking.

The floor truck shown in this same illustration is a special conveyance for connecting rods. It carries more than 50 boards of connecting rods on its racks—more than 400 rods. And there is no chance for the matched sets to get mixed, since they are naturally handled as units by sets rather than by single rods.

•

A Tip for Saving Light

MARK BELL, *Passaic, N. J.*

It is an unusual plant that does not find opportunity to economize by dispensing with certain lights during the summer or when plant operation is low. Frequently many individual lights are installed on a single circuit, making impossible individual control.

Decide which lights are to be eliminated and take out the bulbs. Then, to prevent replacement by some uninformed individual, fit the reflectors with small, tin disks. They will not be unsightly and yet they will prevent the insertion of bulbs.

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Take-Off on Barrel Runway Saves Labor, Speeds Handling

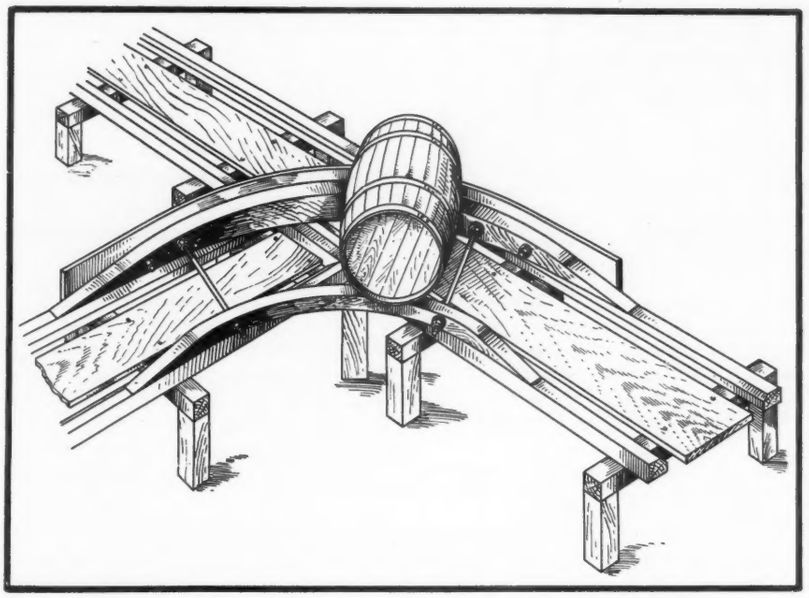
J. E. WRIGHT, *Montreal, Que., Canada*

Installation of portable take-off or curved sections in a barrel runway of an alcohol plant speeded up considerably the handling of barrels and made the work much easier.

Formerly, after the barrels had been filled they were rolled by hand onto a long runway that leads through the yards. This runway is made of 4x4-in. timbers laid 18 inches apart, with a 12-in. footboard between them. At intervals of about 100 feet other runways leading to storage branched off at a right angle from the main runway. When the barrels came to the runway leading to the desired storage space they were rolled upon a small, wood platform, given a quarter turn, and then rolled onto the branch.

Two or three men were required tc turn and guide the barrels, and frequently were not able to handle them fast enough to prevent pile-ups.

The portable, 90-deg. curve was built up of 4x4-in. sections cut to such shape on a bandsaw that they formed a quarter circle when assembled. The outer rail has a radius of about 52 inches; the inner rail has a radius of 29 inches and is about 1 inch lower than the other. The ends



of the rails were tapered down over a distance of 2 ft. to a thickness of 1 in. to afford an easy approach.

As will be seen from the illustration, when in use one end of the take-off is placed on the main runway, with the other end on the branch. The outer rail is supported by a short length of 2x4, the upper end of which is attached by a hinge. When the take-off is not in use the support is folded up and fastened to the outer rail by a hook.

The take-off can be used on either side of the runway, to direct barrels to the right or to the left. Four ½-in. bolts hold it firmly in place.

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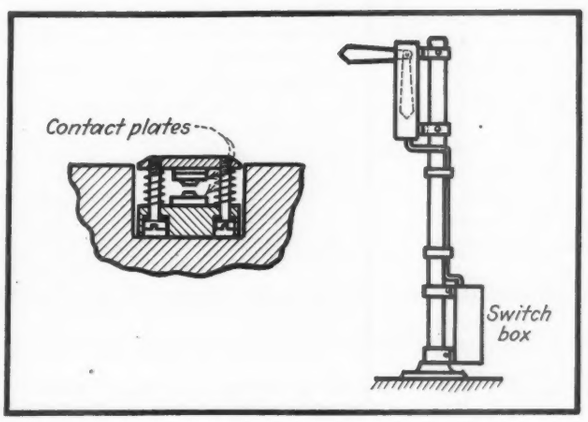
Semaphore Signals for Safety

JOHN A. HONEGGER, *New York*

Usually floor space in a plant is at a premium, yet if collisions of trucks are to be avoided at aisle intersections, equipment must be set back considerably in order to give a clear view in all directions. If motorized equipment is used, the hazard is increased, and the claim on space becomes imperative.

When space is precious and a crossing is dangerous, a semaphore signal erected at the intersection will give ample warning. The signal can be erected either on a floor stanchion or from the ceiling. It consists of a low-priced, low-voltage direction signal of the type used on motor cars and street buses. This signal is fastened to a standard iron pipe length having an end cap screwed on one end and a pipe flange on the other. As the signal mechanism operates on a six- or twelve-volt circuit, a bell-ringing transformer will be required to step down the voltage from the plant lines. In the switch box are mounted two solenoids which operate a simple lever switch. This switch when thrown to the left makes contact; when thrown to the right, it opens the circuit.

To either side of the intersection in each aisle two spring-supported contact plates are recessed in the floor. On the under side of these plates are insulated contacts connected with the solenoids. As a truck approaches the intersection keeping to the right hand side of the aisle, it depresses the contact plate and throws the signal into the warning position. After passing the intersection it depresses a second plate, returning the signal to clear position. Springs supporting the contact plates will support two hundred pounds. Therefore if a man of average weight steps on one, he will not operate the signal.



This installation was tried out where aisles came to abrupt breaks in the press shop of a metal manufacturer. After this apparatus had been installed, there was a noticeable reduction in accidents.

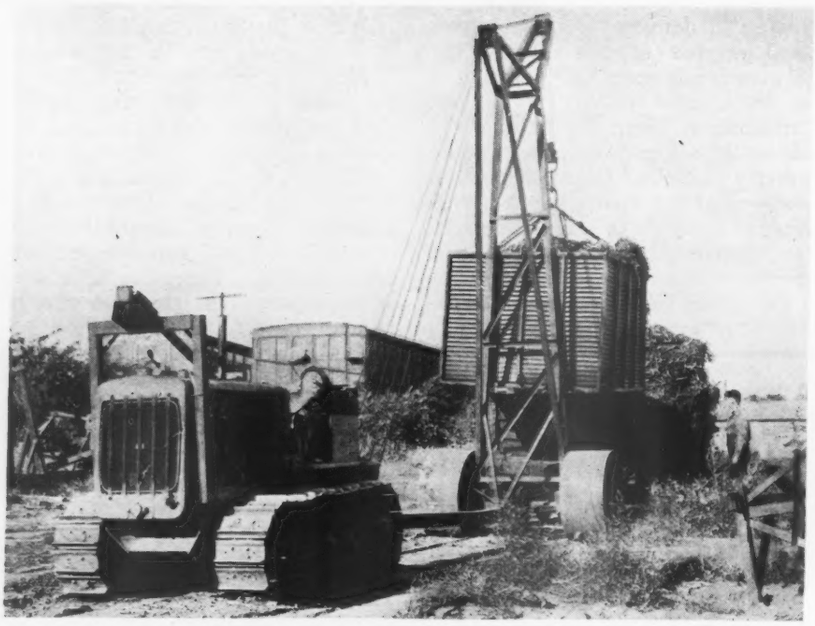
When corrosive exhaust fumes made short work of galvanized iron ducts, one plant engineer built duct of old steel smokestack and oil drums welded together. Two coats of acid-resisting paint finished the job.

Wiping Cloths vs. Waste; Launder or Discard

SOURCE, *Westinghouse Electric & Manufacturing Company East Pittsburgh*

The lowly wiping cloth has been given considerable attention at our plants, and this has resulted in cutting our wiping material costs by more than one half. Our practice was to purchase mill-end wiping cloths and clean cotton waste, all of which was burned when soiled. Cloths have to be used on many operations, because of objections to lint from cotton waste; therefore, both materials are used. The cost of mill-end cloths averages about sixteen cents per pound, and the cost of clean colored waste about six cents.

Tests were conducted to determine the absorption qualities of both materials and it was found that waste is two-thirds more absorbent than mill-end cloths. The next step was to arrange for using waste wherever possible, taking advantage of its lower cost and greater absorption qualities. We investigated the possi-



A combination of tractor and two-wheel crane, designed to solve a difficult construction problem at the Peoria plant of R. G. Le Tourneau, Inc., was discovered to have many other uses. It serves on one handling job after another at the plant, moving and erecting steel, manning lifts for car and trailer loadings, handling heavy equipment. It is shown here loading steel shavings into gondola cars. The Caterpillar diesel tractor pulls, powers, and ballasts the crane

bilities of laundering soiled wiping cloths with the result that a contract was made with a local laundry to do the work at three cents per pound. The laundering price is based on the actual weight of cleaned cloths returned to our plants. It was necessary to make a special drive in the shops to have soiled cloths turned in for laundering rather than permit workmen to throw them away as they were in practice of doing.

Some other companies have found it advisable to use high-grade hemstitched wiping towels because they can be laundered many more times than ordinary mill-end cloths. The mill-end material launders an average of five to six times, whereas the high-grade towels average 30 times. The latter material costs two and one-half to three times as much as the former and, where high-grade wiping materials are used, it is necessary to have a checking system by which each towel given out is recorded. Also, the workmen must turn in a soiled towel in order to obtain a clean one. In our case, it was thought better to use the cheaper cloths and operate without incurring the expense of checking.

At one of our plants laundering equipment was installed several years ago for the cleaning of wiping cloths used at that plant. The installation proved to be profitable and is still in operation; however, as the volume of laundering varies with the rise and fall of business, and such equipment cannot be consistently loaded, we concluded that it would be best to have the work done outside for our other plants.

Care must be exercised when accumulating soiled wiping materials that are saturated with oil or grease, because there is great danger of spontaneous combustion. These cloths should be kept in ventilated metal containers and should not be allowed to pile up in bulk.

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Belt Inspections Scheduled and Recorded

CARL W. SCHWABE, *Superintendent*
Mechanical Department
Mallinckrodt Chemical Works
St. Louis

We have designed two forms that help us keep track of our belt maintenance work. The card labeled Belt Record is filled out when a belt is purchased and is kept in the office as a permanent record that supplies complete information on the cost, inspection, service, and so on. Spaces are provided for recording the conditions noted at the various inspection dates; each time an inspection is made a date can be set when the tension should be taken up again. When this time arrives the form labeled Belt Inspection Report is given to the belt man and serves as his order to make the inspection. The part of the report above the double line, containing data on the length, tension, and kind of belt, is filled in by the office. Data called for in the lower part of the form are filled in by the inspector on the job.

These reports are, of course, posted to the Belt Record Card after

BELT RECORD

BELT SYMBOL

LOCATION
BLDG. FLOOR

DEPT. SYMBOL

PURPOSE
KIND
MAKER
LENGTH
WIDTH
THICKNESS
FASTENING

MAXIMUM TENSION LBS.
MINIMUM TENSION LBS.
DATE DISCARDED
DATE OF INVOICE
COST
COST OF MAINTENANCE
TOTAL COST

DATE RETIGHTENED	TENSIONS IN LBS. BEFORE TIGHTENING	TENSIONS IN LBS. AFTER TIGHTENING	AMOUNT TAKEN OUT	DATE TENSION SHOULD AGAIN BE TAKEN	DATE CLEANED AND GREASED	GENERAL REMARKS AS TO WORK DONE CONDITION, ETC.	MAINTENANCE COST TIME	MAINTENANCE COST MATERIAL	MAINTENANCE COST TOTAL

BELT INSPECTION REPORT

SYMBOL
LOCATION
DATE

LENGTH KIND
MAXIMUM TENSION MINIMUM TENSION

CLEANED GREASED
TIGHTENED REPLACED
TENSION INDICATED BEFORE
TENSION INDICATED AFTER
AMOUNT REMOVED
REMARKS OR RECOMMENDATIONS

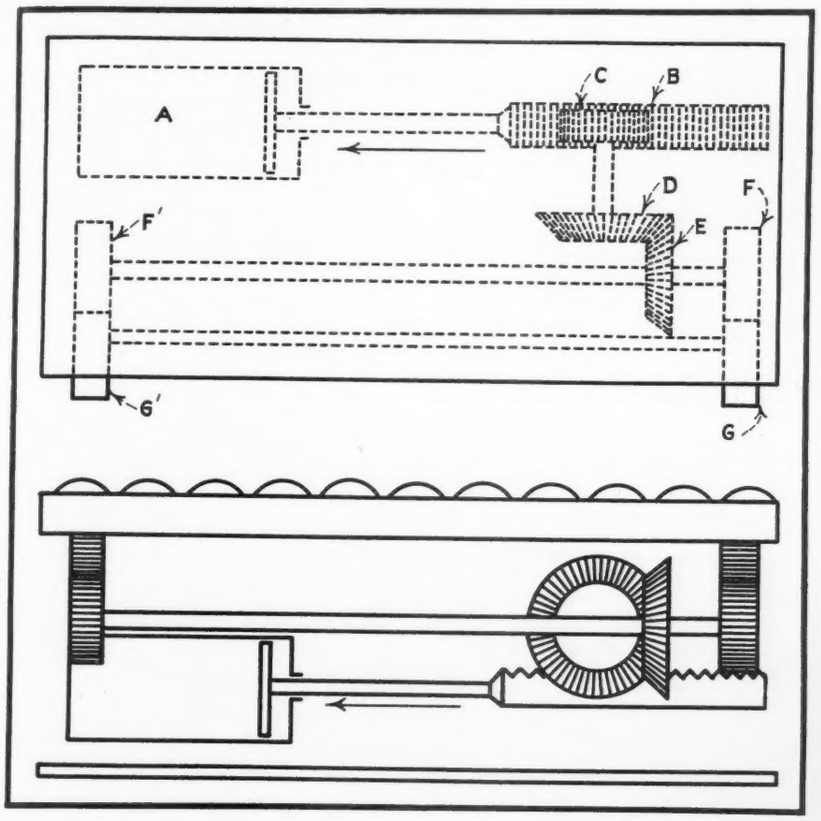
MATERIAL OR SUPPLIES USED

LABOR

SIGNED

they have been returned by the mechanic.

We find that three or four inspections a year are usually sufficient although the number can be varied to meet conditions or needs.



Air-Operated Tilting Table Built as Conveyor Switch

R. A. PERRETT, *Oak Park, Ill.*

On a certain line of conveyors in our plant it became necessary to switch some of the material off to a conveyor running at right angles to the main line. Due to obstructions on the floor, this branch could not be run into the main line in a curve, as is usually done. The branch line, therefore, had to run straight into the main line. In order to switch the material onto the branch line, a section of conveyor in the main line was removed and replaced with the dumping table shown in the sketch. It was necessary to design this table so that it was a self-contained unit which could be moved away when necessary. Because the conveyor was low at the point of installation, a special design of the mechanism that was to operate the table had to be made.

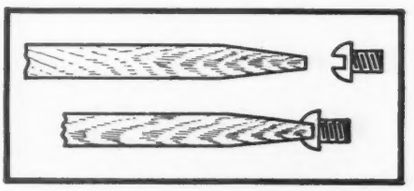
A double-acting air cylinder A was placed in a horizontal position parallel to the axis of rotation of the table top. To the piston rod was joined a rack B, which meshed with gear C. Gear C was mounted on a shaft with bevel gear D, which, in turn, meshed with bevel gear E. Gear E was mounted on a shaft with gears F and F′. With these two gears meshed the gear segments G and G′. These segments were fastened to the table top, tipping the top as air was admitted into the cylinder. The cylinder was connected to the operating valve by pipes (not shown), and the air supply was furnished through a rubber hose, using a coupling similar to that used on portable air tools.

In operation, the material that should travel along the main line passes over the table and on along the line. When material is to be switched off onto the branch line, a trigger switch is set so that when material hits it, the tilting mechanism operates. After the material has slid off, the table returns to normal position.

Wooden Screwdriver for Hard-to-Reach Places

KENNETH S. SMILEY, *Plant Engineer*
Kendall Mills, Inc.
New Bedford, Mass.

A piece of wood—often a match or splinter will serve—may be used to introduce a screw into a screw hole difficult of access.



The match or splinter is filed or cut at one end so that a wedge is formed to fit tightly into the slot of the screw. In this manner the screw can be introduced into the screw hole and partially tightened. Usually a screwdriver will be required to finish the job, though a surprising amount of force can be applied through a hard-wood "screwdriver."

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An ammeter in the motor circuit of this grinding machine in the plant of the American Machine and Foundry Company, Brooklyn, N. Y., helps the operator get maximum output without overloading the motor. Feed is adjusted to keep the current within the desired range

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SPECIAL NOTICE. . . . $10 will be paid for the best Operating Short submitted during the month of February. The Editors are the judges. Other Shorts accepted will be paid for at attractive rates

Questions & Answers

CONDUCTED BY

G. A. Van Brunt

Slow Worker Wants a Raise

One of my men has asked for a raise in pay, which I do not think he is entitled to. He is slow and rather clumsy, with an opinion of himself and his worth which is not warranted by his record of performance with our company.

On the other hand, he has been with us for a long while and other men with shorter service records have received promotions or raises. How should such a case be handled?

SOME years ago the Franklin Motor Company used a plan which might be applicable here. They included in the man's base rate a small differential for length of service, as distinguished from the record of performance. Thus, an individual getting 50 cents an hour would automatically get a raise of, say, 1 cent an hour at the end of the first, third, fifth years, and so on up to the limit for the job. To exceed that limit he had to qualify for a higher-paid rank.

Another answer to the same question came as a byproduct of some motion picture work in a plant. A study was made of several workmen doing the same task. One of these men it so happened, was dissatisfied with his rate and asked for a raise. The picture clearly showed how much slower his performance was than that of the man earning the rate which the dissatisfied individual thought he should receive. In answer to his request for a raise he was shown the picture and told that he could earn the raise by studying and equalling the other man's performance.

In general, the better and more accurately defined the company's standards of performance are, the less trouble will be experienced in answering unwarranted requests for raises. If standards are fairly set the applicant can be told to write his own ticket, and be given help in doing so.

•

How Fill Cracks in Wooden Beams?

Large cracks appear occasionally in the wooden beams of our plant buildings. They are unsightly and make us wonder whether they indicate structural weakness. If any readers have had similar experience it will be appreciated if they will explain what causes these cracks and tell us the best methods and materials to use for filling them, in order to prevent further deterioration and make them less conspicuous.

—R.F.

LONGITUDINAL cracks in wooden beams are due to excessive dryness or improper seasoning and are technically known as "checks." Excessive dryness has the effect of accelerated seasoning, causing unequal drying through the beam and setting up internal stresses which are manifested by checks.

Short, shallow checks are to be expected in most beams and although they have a slight effect on the strength there is ample provision for them in the usual working stresses allowed. Long, deep cracks which are noticeable enough to be unsightly may dangerously weaken the beam. Beams that show them should be carefully watched for other evidences of weakness, such as sagging floors and unusual deflection under load, and be replaced if these conditions exist.

Where checks are short and shallow, or extend only along the middle of the beam, there is little danger. The best way to prevent further drying is to

(Continued on advertising page 68)

Answers Wanted

How Test Condensers for Shorts?

I wish that some reader would tell me the best way to test the condensers in capacitor motors for short circuits. On several occasions I have checked such condensers by means of a test lamp connected in series with the condenser, and a light will be obtained whether or not the condenser is shorted. There must be some quick and easy way of testing these condensers. What is it? *—G.W.*

Exciter Lost Residual Magnetism

A puzzling trouble has developed with a 75-hp., 440-volt, 60-cycle synchronous motor, direct connected to an air compressor having an unloading device. Exciting current is supplied by an m.g. set at 125 volts; normally, the load is 23 amp. The motor is started by a pushbutton.

Recently the commutator of the exciter was polished with sandpaper and blown off with compressed air. The motor started as usual and showed no signs of trouble, but after carrying a load for ten minutes it began to hum and groan, and the d.c. ammeter failed to indicate.

While checking the circuits one of the exciter brushes was found to have almost no tension. This was remedied and the motor was started again, but the d.c. ammeter still failed to indicate, although the motor came up to synchronous speed and varying the field resistance had some effect on the motor. A 230-volt lamp placed across the field terminals of the motor glowed. The motor seemed to carry its load satisfactorily.

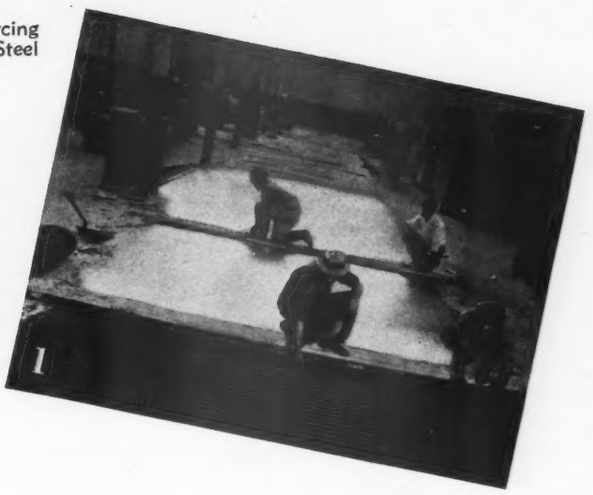
Then it was stopped to check the d.c. circuit. Since the ammeter seemed to be out of order, we decided to operate without it, but when load was applied, the motor hummed and groaned again. A lamp placed across the field terminals did not glow, and varying the field resistance had no effect on the motor. Checking the exciter showed that it had lost its residual magnetism.

Is it possible for an exciter to lose its magnetism if the brushes lose contact with the commutator, while in operation? Do you think that the exciter is the cause of all our trouble? What other conditions could make the synchronous motor behave as it did? *—W.H.*

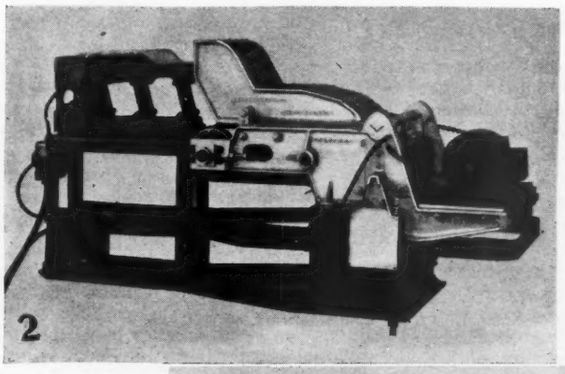
What Steel for Machine Bolts?

Occasionally it is necessary to make oversize machine bolts by turning down and threading hexagon stock. We want these bolts to have the maximum strength possible to obtain without heat-treatment. Facilities for heat-treating are not available and the small number of bolts made would not warrant installation of such equipment. What grade of hexagon steel stock will give maximum strength without heat-treatment, and at the same time not be too hard or tough to be machined with ordinary equipment? *—H.F.*

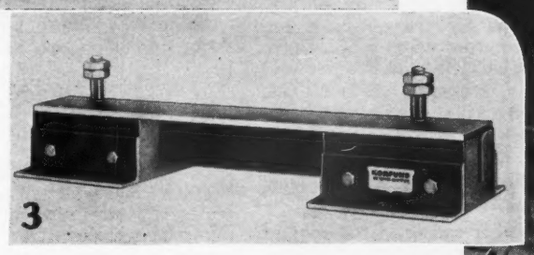
Flashes from the equipment makers



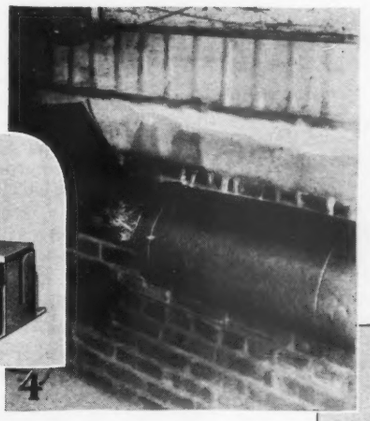
1 Heavy duty reinforcing steel for floors. Acme Steel Company, Chicago



2 Constant-weight feeder for continuously weighing and feeding materials at selected rates. The Jeffrey Manufacturing Company, Columbus, Ohio

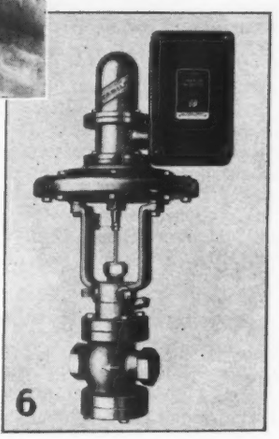


3 "Seismo-Damper" for isolating machine vibration. The Korfund Company, Inc., Long Island City, N. Y.



4 Waterproofed rock wool insulation for cold pipe lines. Johns-Manville Corporation, New York

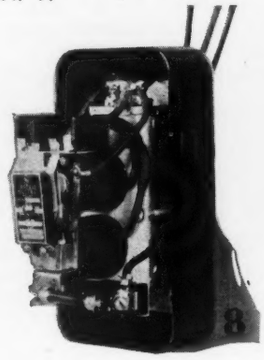
5 Spray gun for corrosive materials. The DeVilbiss Company, Toledo



6 Vernier attachment for assuring accurate valve positioning. The Foxboro Company, Foxboro, Mass.

7 Hydraulic press for molding plastics and rubber. Farrel-Birmingham Company, Inc., Ansonia, Conn.

8 Relay for automatically reclosing circuit breakers. General Electric Company, Schenectady, N. Y.



What's NEW in Equipment

Air Conditioning, Ventilating, Heating

Cooling Units—Two Freon units for air conditioning and water cooling. Inclosed-type compressors. Fifteen-ton machine is driven by 15-hp. motor and has three vertical cylinders. Twenty-ton machine has 20-hp. V-motor. Frick Co., Waynesboro, Pa.

Heating System Zone Control—For Tallmadge heating system. Pressure switch controls current to motor operating damper control. Modulating valve reduces steam pressures over 100 lb. as low as a fraction of an ounce. Hoffman Specialty Co., Waterbury, Conn.

Heating Unit—Fin-type Calrod heating unit for air heating. Steel fins copper-brazed to steel sheath. General Electric Co., Schenectady, N. Y.

Leak Detector—For locating leaks in refrigerating and air-conditioning units. "Prest-O-Lite Halide Leak Detector." Linde Air Products Co., 30 East 42d St., New York.

Unit Conditioners—For cooling and dehumidification. Can be installed with or without ducts. High or low pressure types. Automatic float control for refrigerant. Low outlet velocities. Heavy steel casing. FB-500, FB-800, FB-1400 and FB-2000. York Ice Machinery Co., York, Pa.

Bearings

Ball Bearings—Seventy-five sizes of radial and angular-contact type ball bearings. Single- and double-row types, available with one or two lubricant seal plates. Hoover Steel Ball Co., Ann Arbor, Mich.

Building Materials

Floor Steel—"Acme Heavy Duty Floorsteel." Network of 1¼x1¼-in. mesh made of sections of rolled steel. Laid flush with finished floor and fitted with concrete or asphalt. Non-skid surface. Acme Steel Co., 2831 Archer Ave., Chicago.

Electrical Control

Contactor — Low-voltage, a.c. contactor which will stay closed through voltage disturbance or failure. Direct-current magnet holds contactor closed. General Electric Co., Schenectady, N. Y.

Controllers—For current input on electrically heated circuits. Four models: Model M prevents overshooting when constant load is wanted; Model MT does same but also has time control; Models F and FL are designed for variable loads. Automatic Temperature Control Co., Inc., 34 East Logan St., Philadelphia.

Panelboard — For toggle switches. Dead-front construction with door covering switch levers and fuses. Accommodate 4-24 circuits. Wadsworth Electric Mfg. Co., Covington, Ky.

Relay—Thermal-induction relay for use in oil-immersed motor controllers. Manufacturer claims no difficulty in starting high inertia loads at full voltage. General Electric Co., Schenectady, N. Y.

Speed Regulators—Manually operated, transformer, speed regulators for high- and low-torque capacitor motors. For single-phase motors up to 2 hp. and polyphase motors up to 5 hp. Units consist of tapped auto-transformer and snap switch. General Electric Co., Schenectady, N. Y.

Switch—Oil-immersed 15-kv. disconnect switch. Water- and dust-tight. Delta-Star Electric Co., 2400 Block, Fulton St., Chicago.

Switch—Shipper-rod-operated master switch which performs function of two-button, momentary-contact, pushbutton station. General Electric Co., Schenectady, N. Y.

Switchboards—"Streamlined." Steel switchboards with all instruments built-in. Instruments project about one inch from panel front. General Electric Co., Schenectady, N. Y.

Electrical Protection Devices

Automatic Breaker Recloser—One-shot instantaneous relay. Resets automatically if breaker stays closed, or locks out if breaker trips again in few seconds. Type HG-18. General Electric Co., Schenectady, N. Y.

Circuit Breaker — Air-blast type. Arcing and disconnecting contacts. Range 64-50 kw.; rupturing capacities 100-600 mva. Brown Boveri & Co., Ltd., Baden, Switzerland, and New York.

Fuse — Type-C fuse for confined spaces. Capacities ½-400 amp. for 7.5, 23, and 34 kv. systems. Schweitzer & Conrad, Inc., 4435 Ravenswood Ave., Chicago.

Fuse Cutout — Capacity 150 amp. Door remains closed when fuse drops out. Two voltage ratings: 5,000 and 7,500 or 12,500. Line Material Co., Milwaukee.

Exhaust Systems

Dust Collector—"The American Dustube Collector." Long tubes of special woven fabric are hung from racks in ceiling. Spring suspension of tubes maintains proper tension on cloth. Self-acting dust seals hold tubes to bottom. The American Foundry Equipment Co., Mishawaka, Ind.

Painting Exhaust Chamber—For ceramic spray booths. Fumes are exhausted into 7½-hp. exhaust unit. Dampers on each exhaust booth permit individual regulation of exhaust chambers. Binks Mfg. Co., 3114 Carroll Ave., Chicago.

Food

Drying Equipment — Wet material drops from hopper onto revolving, grooved and heated cylinder. Roller presses material into grooves from which it is stripped by pins which bear against cylinder. As it falls on conveyor it is moved to drying chamber where process is completed. Proctor & Schwartz, Inc., Tabor Rd., Philadelphia.

Flaking Mill — Double anti-friction bearings. Variable-speed drive on feeder; roll pressure indicating device. Handwheels for scraper adjustment. Allis-Chalmers Mfg. Co., Milwaukee.

Ice Machine — "Pak-Ice." Machines with 2-30 tons per day capacity produce ice in crystal or briquet form. Process takes 20 minutes. Vilter Mfg. Co., South First St., Milwaukee.

Grinding and Buffing

Buffing Material—"Glo-Lime." Made of lime and grease. For coloring nickel, copper, brass, aluminum, and plastics. Two sizes of three grades each. E. Reed Burns Mfg. Corp., Jackson St., Brooklyn, N. Y.

Buffing Wheels—Cloth pretreated by "humidifying" process to give proper moisture content to fibers for strength and wear-resistance qualities. Udylite Co., Detroit.

Grinder—Mold "AA" grinder for cemented carbide tools. Rough and finish grinding. Two quick-setting tables with graduated indexes. Thomas Prosser & Son, 15 Gold St., New York.

Grinder—"No. 72-A Gap Internal" grinding machine. Has 39-in. swing over gap bed; will handle work 15 in. long. Hydraulic table drive. Guard swings back so that loading and unloading can be done by overhead crane. Heald Machine Co., New Bond St., Worcester, Mass.

Grinders — General purpose, 7-in. grinders. Three models: pedestal, driven by single- or 3-phase motor; bench, driven by single-phase motor; and belt-driven. Delta Mfg. Co., Milwaukee.

Grinders — "200" Series. Standard motors. Spindle speeds can be varied. Standard universal lever-feed tables. Gardner Machine Co., Beloit, Wis.

Wheel Dresser — Diamond-impregnated wheel dresser containing extra coarse mesh of diamonds. Carboloy, Inc., 2985 East Jefferson Ave., Detroit.

Instruments and Meters

Controller—For combustion control or control of liquid levels, pressures, and rate of flow. Actuating member may be diaphragm or lever. A. W. Cash Co., 16th and Eldorado Sts., Decatur, Ill.

Flowmeter — Recording flowmeter measures differential pressure across orifice, venturi, or pitot tube. Measuring element is flexible metallic bellows whose movements are transmitted to pen arm. Morey & Jones, Ltd., South Hemlock St., Los Angeles.

Gage — Semi-automatic gage for manual operation on material up to 1 in. in diameter. Vacuum-tube relays cause indicator lights to light, indicating whether material is undersize, right size, or oversize. Model LR2. The Electronic Inspection Laboratories, Prospect Ave., Cleveland.

Gage-Pressure Equalizer—Regulates valves, water-level controls, and instruments subject to shock or pulsation. Made in brass and non-corrosive bronze. National Boiler Improvement Co., Inc., Georgia Ave., Washington, D. C.

Meter — Measures air pressure or vacuum and air velocities. Measures velocities 140-2,832 ft. per min., pressures 0.00125-0.50 in. of water. Julien P. Friez & Sons, Inc., Baltimore, Md.

Meter Mountings—Three. "All-Service" and "Enclosed" for I-20A bottom-connected, watt-hour meter. "Socket Type" for I-20S socket-type meter. General Electric Co., Schenectady, N. Y.

Time Meter—Totals running or idle time on electrically operated tools and machines. Registers up to 9,999 hours before repeating. Has 120-volt, 60-cycle, a.c. synchronous motor. Westinghouse Electric and Mfg. Co., East Pittsburgh.

Valve Controller — Eliminates valve sticking and assures hairline valve positioning on air-operated control valves. Manufacturer claims that instrument is sensitive to air changes equivalent to ½ in. of water. "Vernier Valvactor." Foxboro Co., 24 Neponset Avenue, Foxboro, Mass.

Lighting

Spotlight—Adjustable shop spotlight for office and factory can be swung in all directions. Three types: one for wall mounting, one for bench mounting, and one for machine mounting. Chicago Die Casting Mfg. Co., West Monroe St., Chicago.

Transformer and Reactors—For mercury vapor lamps. Four styles, inclosed and open types. Jefferson Electric Co., Bellwood, Ill.

Lubricants and Lubricating Devices

Oiler—Adjustable, universal-type Oilit. Vacuum-type constant level oiler. Visible oil level. National Industrial Products Corp., Wilkinsburg, Pa.

Materials

Material for Bobbins — "Bakelite-Rogers Board" suitable for fabrication of spools and bobbins. Consists of pulp and fibrous products treated with Bakelite resinoid. Bakelite-Rogers Co., Inc., 274 Park Ave., New York.

Stainless Steel—"Carpenter Selenium 18-8 Stainless." Has qualities of regular 18-8 stainless but is easier to machine. The Carpenter Steel Co., Bern St., Reading, Pa.

Materials Handling

Bucket Conveyor—Improved design of tripper to give complete turnover of each bucket. Totally inclosed drive; steel gears running in oil. Bucket width: 18, 24 and 30 in. Travel speed, 40-48 ft. per min. Drive motor, 7½-25 hp. Robins Conveying Belt Co., Park Row, New York.

Constant Weight Feeder—For continuously feeding and weighing materials accurately. Vibrating feeder controlled electrically by a balanced weighing belt. Cabinet control box may be mounted at distance from feeder. Operates from a.c. light circuit. The Jeffrey Mfg. Co., 911-99 N. Fourth Street, Columbus, Ohio.

Constant Weight Feeder—Improved model of "Conveyometer." Has self-correcting device which insures correct weight even though rate of flow or specific gravity of material change. Richardson Scale Co., Van Houten Ave., Clifton, N. J.

Dump Truck—Two- or three-wheel mounting. Made of ⅛-in. steel plate and welded. Capacity, 27 cu.ft. Rubber tires. Overall height, 48 in.; wheelbase, 30 in.; overall length, 89 in. Easton Car & Construction Co., Farrell St., Easton, Pa.

Sling Chain—Has short, narrow links. Chain and fittings are Herc-Alloy steel. Made in standard sling and other styles, and to individual specifications. Columbus McKinnon Chain Corp., Tonawanda, N. Y.

Truck—Box truck. Made of Dilecto sheets mounted on frame of Monel and hardwood. Said to be resistant to chemical fumes and high humidity. Any type casters. Continental-Diamond Fibre Co., East Newark, Del.

Truck Wheel—Improved design has ⅛-in.-thick steel disks mounted on side of wood segments, increasing load capacity. Sizes, 2½-20 in. in diameter. Metzgar Co., Inc., Logan St., Grand Rapids, Mich.

Mechanical Power Transmission

Belts—Endless woven belts. Manufacturer claims that belts are preserved against oil and heat. Made in any width and in circumferences from 12 in. to 14 ft. Globe Woven Belting Co., Inc., Buffalo, N. Y.

Motor Base—"Straitline Automatic Ball Bearing Motor Base." For use with Vari-Pitch Texrope Sheave. Dial indicator shows belt tension. Handwheel controls speed of sheave and moves motor. Allis-Chalmers Mfg. Co., Milwaukee.

Motor Drives—For belt-driven machine tools. "Junior" motor drive is made for lathes, shapers, and milling machines. Will mount motors ¾-5 hp. "Universal" type has base that fastens to floor, is made in two sizes delivering 1-2 and 3-5 hp. W. L. Steege Machinery Co., South Clinton St., Chicago.

Motor Unit—For belt-driven lathes. Can be mounted behind lathe head or on floor. V-belt drive. Three sizes: ½, 1, and 2 hp. Motor used, 1,200 r.p.m. Adjusting nut for belt tension. Sebastian Lathe Co., Culbert St., Cincinnati.

Metal Finishing

Polishing and Buffing Machine—Fourteen wheel heads, each adapted to any type of polishing or buffing. Variable-speed drive advances work while second variable-speed drive rotates it. Polishing wheel speeds range 2,485-3,045 r.p.m. Automatic applicator for applying polishing compound is integral with each wheel head. Length 42 ft., width 7 ft. The Packer Machine Co., Meriden, Conn.

Metal Working

Boring Machine—One or more spindles can be mounted on each of three spindle platens. Six No. 1 or 1L spindles can be used, or three No. 3. Spindle speed range 300-5,000 r.p.m. Maximum feed length, 12 in.; diameter of holes, ⅜-8 in. Space for fixture, 16 in.sq. Stoker Unit Corp., West Rogers St., Milwaukee.

Cutter-Head Grinder — Collet & Engelhard automatic cutter-head grinder for grinding milling cutters and inserted blade cutter heads. Grinds face, side, and chamfered edge. Two speeds, 2,850 and 475 r.p.m., for grinding high-speed alloy tools. Two sizes: one for cutters 4-16 in. in diameter, other for cutters 6-28 in. in diameter. W. A. Schuyler, 250 West 57th St., New York.

Die-Casting Machine—For pressure die-casting of lead- or zinc-alloy parts requiring inserts of other metals or materials. Pneumatic operation. Will take multiple-cavity dies. Castings can be made on 5-ft. inserts. Metal pot capacity, 675 lb. of lead. Model 7. Madison-Kipp Corp., Madison, Wis.

Dies — Adjustable perforating and notching dies for sheet metal. Center distance can be set as close as 1½ in. Punches up to ⅛-in. stock S. B. Whistler & Sons, Inc., Military Rd., Buffalo.

Drill Grinder—No. 21. Drill is set in jig which is transferred to machine and ground without further adjustment. Point angle 80-180 deg. can be ground. Rated for drills from 3/32-½ in., but sizes up to No. 57 can be ground. Oliver Instrument Co., Adrian, Mich.

Dryer—Centrifugal drying machine with 12x12-in. baskets inclosed by welded cover. Motor is mounted at side and drives basket by V-belt. Motor is ¾ hp., rotates at 1,750, drives basket at 725 r.p.m. Crown Rheostat & Supply Co., Maypole St., Chicago.

Electric Furnace — Continuous furnace for brazing and annealing. Endless mesh belt conveys work through special atmosphere produced by generator furnished with furnace. Four standard widths. Electric Furnace Co., Wilson St., Salem, Ohio.

Electric Furnace—For bright annealing cold-drawn, seamless steel tubing. Furnace divided into three sections for preheating, heating, and cooling. Several sizes. Electric Furnace Co., Salem, Ohio.

Electric Furnace — Induction type Used with 3-kw. converter. Two sizes: 2- and 4-lb. capacities. Operating current, 25-30 amp.; from 220-volt, 60-cycle line. Ajax Electrothermic Corp., Trenton, N. J.

Furnace, Tempering — Heating element held in extension from circular furnace inclosure. Fan blows air over heating element into furnace section. Maximum temperature 1,250 deg. F. Electrical ratings for four sizes range from 12 to 52 kw. Lindberg Engineering Co., Union Park Ct., Chicago.

Lathe—Universal turret lathe, 4-A. In 8- and 9-in. spindle capacities and 28¼-in. swing. Hard steel replaceable wear strips on seat of cross-slide. Direct-reading indicator in head gearshift. Independent leadscrew used for threading. Quick return of carriage at constant speed of 5 ft. per min. Warner & Swasey Co., Cleveland.

Metal Cleaner — "Metso 66." For cleaning metal prior to plating or enameling. Powder, to be dissolved in water. Can also be used without mixing to remove grease. Philadelphia Quartz Co., South Third St., Philadelphia.

Milling Machine—Producto-Matic No. 130. For milling locating spots or pads on crankshafts preparatory to center turning of bearings. Double-action movement, obtained by vertical movement of upper and lower spindle arbors and horizontal movement of table. All movements controlled and synchronized by cams. Producto Machine Co., Bridgeport, Conn.

Press—Four-point suspension press; two shafts with two connections each help keep alignment between slide and bed. Electrically controlled, air-operated friction clutch and brake. Double-roll feed synchronized so that ram stops if correct amount is not fed into press. The Cleveland Punch & Shear Works Co., Cleveland.

Press—No. A-4 inclinable open-back press. Forged and ground main shaft is 4 in. in diameter. Six-point engagement clutch; support for die from center to front and center to rear. Motor drive on top; compensating brake. One-man including device. Niagara Machine and Tool Works, Buffalo, N. Y.

Presses, Hydraulic and Screw—Line of presses including 25-, 40- and 60-ton hydraulic presses and 25- and 35-ton screw presses. Wright Manufacturing Division of American Chain Co., Inc., York, Pa.

Spline Shaft Grinder—For grinding sides of keys and root diameter of spline shafts having either straight or helical splines. Headstock is motor-driven and automatically indexed. Table is hydraulically traversed with maximum speed of 30 ft. per min. Assembly may be swiveled. Fitchburg Grinding Machine Corp., Fitchburg, Mass.

Spring Tester — Type RP "Elasticometer" spring testing machine. Capacity 750 lb. If lengths do not vary too much, 600 springs per hr. can be tested. Coats Machine Tool Co., Inc., West 40th St., New York.

Trimmer and Beader—Trims flash and beads stamping in one operation. Rectangular and round stampings of large and small sizes can be handled. Quickwork Co., St. Marys, Ohio.

Turret Lathe—No. 3-F, addition to Fastermatic line. Four sizes. Four sets of four changes give 16 spindle speeds. After range has been selected, changes are made by forward movement of turret unit. Bridge-type cross-slide. Foster Machine Co., West Beardsley, Elkhart, Ind.

Worm-Thread Grinder — Portable; motor-driven. V-belt drive. Handwheels for crossfeed, horizontal, spindle elevation, and motor adjustments. Universal wheel dressing attachment available. Three sizes: 1, 3 and 5 hp., for any voltage. The Hisey-Wolf Machine Co., Cincinnati.

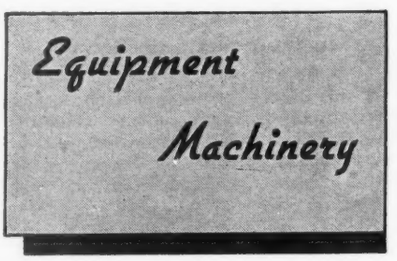
Miscellaneous

Acid Ejector — For removing acids from carboys. Consists of acid-resisting pipe, connection for neck of carboy, air inlet, and small compressor. Lea Mfg. Co., Waterbury, Conn.

Bottling Machine — Vacuum type. Three filling stems. Operated by crank handle. All-metal construction. "Cinati Jr." Karl Kiefer Machine Co., Martin St., Cincinnati.

Crusher—Improved design has ball bearings on rotating units. For crushing charcoal, chemicals, food ingredients, etc. Can be adjusted for fine or coarse grinding. Sprout, Waldron & Co., Inc., Waldron St., Muncy, Pa.

Gas Generator—"R-C Harrison Inert Gas Producer." Capacity, 1,000 cu.ft. per hr. Consists of blower and gas



pump for air and gas, water-cooled combustion chamber where gas is burned, and a cooler to reduce temperature of inert gas to desired point. Electric motor or gas engine drive. Roots-Connersville Blower Corp., Connersville, Ind.

Measuring Pump — Double-acting pump delivering ½ or 1 oz. of oil, glycerine, or other liquids with each complete stroke of plunger. V. R. Hall Products Co., Amesbury Ave., Cleveland.

Metal Marker — "Electro-Graphic Graver." Writes and marks on metal surfaces of any hardness. Operates on a.c. current or from battery. The Electro-Graphic Graver Co., Toledo, Ohio.

Numbering Machine — For stamping numbers or letters on metal surfaces. Made of steel. Hammer blow forces impression. American Numbering Machine Co., Shepard St., Brooklyn, N. Y.

Paint Stick—"Markal." Two types: one for cold marking, one for hot marking. Five colors. Helmer & Staley, South Parkway, Chicago.

Spray Gun—For spraying acids or materials corrosive to steel, brass, and other metals. Made from Bakelite base. Semi-automatic. The DeVilbiss Co., Toledo, Ohio.

Tank Supports—Adjustable tank supporting jacks. With drop forged and cast saddles. Several sizes. Templeton, Kenly & Co., South Central Ave., Chicago.

Vibration Damper—"Type-T Seismo-Damper." For medium and light ma-

chinery. Sizes of 100-2,500 lb. capacity. The Korfund Co., Inc., 4815 32d Pl., Long Island City, N. Y.

Water Treatment—"Sodium Chrom Glucosate." For control of corrosion in water system where water is not for human consumption. D. W. Haering & Co., Inc., Monroe St., Chicago.

Molding

Hydraulic Press—Uses oil as fluid medium. Designed especially for plastics and rubber molding. Capacity, 100 tons. Platens, 20 in. square with 12-in. opening between platens. Steam and oil pressure gages mounted in white-enameled depression in front face of top crosshead behind shatter-proof glass. Farrel-Birmingham Co., Inc., Ansonia, Conn.

Motors

Geared Motor Reducers—Fractional-horsepower geared motors for direct connection to any application requiring special speeds. Single- and double-

reduction types with right-angle shaft drive; single-, double- and triple-reduction with parallel shaft drive. Wagner Electric Corp., 6400 Plymouth Ave., St. Louis.

Motor—For individual loom drives. Sizes, ½-2 hp. For either 2- or 3-phase, 60-cycle operation, in voltages 220-550. Allis-Chalmers Mfg. Co., Milwaukee.

Packaging

Carton Liners — Waterproof liner insulates packing cartons. In single piece. Jiffy Pad & Excelsior Co., 11th Ave. and 29th St., New York.

Paint and Painting Equipment

Airfinishing Booth — Self-cleaning. Type F-766. Water spray automatically washes material and fumes from air distributing plates onto removable collector screen. Water vapor removed by ventilator. Made of heavy galvanized metal, furnished complete with water nozzles, piping, strainer, and fittings. Paasche Airbrush Co., 1901 Diversey Parkway, Chicago.

Pump — "Barrett Century Barrel Pump." Will handle oils, thinners, and non-viscous paints. Requires no priming. The Cleveland Brass Mfg. Co., 4606 Hamilton Ave., Cleveland.

Spray Gun Caps—Air caps for Type MBC spray gun. No. 76 has three auxiliary jets; designed for lacquers and heavy-bodied synthetics. No. 54 is twin-jet type. The DeVilbiss Co., Toledo, Ohio.

Piping, Valves, and Fittings

Gasket—Style D gasket for raised face, plain, VanStone, or Cranelap pipe flanges. For pressures up to 1,500 lb. One-eighth inch thick. Flexitallic Gasket Co., Camden, N. J.

Pipe Insulation—For cold lines. "Rock Cork Pipe Covering." Made of waterproof rock wool. Fittings insulated with multiple layers of Zerotex. Johns-Manville Corp., 22 East 40th St., New York.

Valve—Iron gate. "O.I.C." Can be repacked under pressure. For 200-lb. service. Stationary stem on sizes ¼-2 in. Ohio Injector Co., Jector St., Wadsworth, Ohio.

Valve—Multi-way. Has five inlets and outlets and a closed position. Three sizes: 2, 2½ and 3 in. Sall Brothers Co., Rockford, Ill.

Valve—Pressure relief valve. Standard sizes of ½- and ¾-in. inlet, with ½-in. outlet, for pressures up to 75 lb. Brass. Adjusting screw inclosed in cover cap. Central Brass Co., East 55th St., Cleveland.

Valve — "W.E.W." regrinding-type valve. Two sizes: extra heavy for 250 lb. working steam pressure. Double extra heavy for 300 lb. pressure. Made in cast iron and cast steel. William E. Williams Valve Corp., 62 Front St., New York.

Valves—Two. "Century Union Bonnet" in sizes ¼-2 in. for 200 and 300 lb. W.S.P. Has non-rising stem; designed for use with chemicals and oil. "Hi-Lift" V-part valve made in same sizes; in bronze up to 150 lb., steel up to 300 lb. H. Belfield Co., Philadelphia.

Power Plant Equipment

Air Compressors—Line of air compressors, including both single- and double-stage units in permanent and portable styles. Wright Manufacturing Division of American Chain Co., Inc., York, Pa.

Air Hose—Resistant to hot oil from compressors. Twisted-cord plies impregnated with rubber compound. Republic Rubber Co., Youngstown, Ohio.

Cinder Burning Equipment—Improved design. Returns unburned cinders to boiler furnace. Has self-feeding intake with dust-tight valve for connection to soot and cinder hoppers. Large size will handle 4 tons per hr.; small size, 1 ton per hr. United Conveyor Corp., West Van Buren St., Chicago.

Compressors—Line of 2-stage, sliding-vane, rotary air compressors for pressures up to 100 lb. gage. Single casing for 2 stages and intercooler. Ratings: 20 hp., 1,740 r.p.m. to 100 hp., 690 r.p.m. Allis-Chalmers Mfg. Co., Milwaukee.

Diesel Engine — Type RHB. High-compression type. Direct injection. Water-jacketed cylinder head. Compressed-air starting. Sizes, 100-800 hp. Force-feed lubrication. Fuel filter. Trunk-type pistons with six working rings and two oil-control rings. Chicago Pneumatic Tool Co., 6 East 44th St., New York.

Diesel Engines—Three models: D-17000 is V-type, 8-cylinder, 160-hp.; D-6600 is 3-cylinder, 60-hp.; D-4400 is 4-cylinder, 44 hp. Gasoline starting engine. D-17000 and D-6600 have governed speed of 850 r.p.m., D-4400 of 1,400 r.p.m. Caterpillar Tractor Co., Peoria, Ill.

Feedwater Heater — Non-deaerating type stationary feedwater heater. Interchangeable pan system. Multi-baffle separators. Two-pass filter. One-piece cast iron body operating under 15-lb. working pressure. Worthington Pump and Machinery Corp., Harrison, N. J.

Fuel Oil Heater—Three types. Type O is straight-tube, multi-pass design operating with pressures of 250 lb. oil and 150 lb. steam. Type D is U-tube design, for pressures up to 125 lb. Suction type is U-tube design, intended for installation in oil storage tanks. Patterson-Kelley Co., Frommer St., East Stroudsburg, Pa.

Meter — "Beckman" pH meter for hydrogen-ion determinations. Glass electrode with heavy membrane. Two controls. Temperature compensator. Fisher Scientific Co., Forbes St., Pittsburgh.

Pulverizer—"Raymond." For pulverizing coal and similar materials. As material is ground, it works upwards until picked up by air current which carries it to separator. Spring pressure release prevents damage from ungrindable material. Read Machinery Co., York, Pa.

Pump—Positive displacement, reciprocating pump. Capacity 15-120 gal. per hr. Pressures 0-500 lb. Operates on 1/6-½-hp. electric motor. Can be used for pumping water, oils, and chemicals. Homestead Valve Mfg. Co., Coraopolis, Pa.

Pumps—"Class A Axial Flow Pump." For low head conditions. Pump casing is in shape of tube and forms part of water passage. Rotation of propeller in casing forces water through system. Pennsylvania Pump and Compressor Co., Easton, Pa.

Pumps—Three rotary, helical-geared pumps. Nos. 1S, 2S and 3S. For use with clean liquids. Direct drive at ordinary motor speeds. Renewable bronze bearings. Brown & Sharpe Mfg. Co., Providence, R. I.

Steam Purifier—For cleaning saturated steam that is to be metered. Prevents mud or dirt from clogging small pipe lines connecting meter orifice to meter body. The Reaco Co., 146 West Mound St., Circleville, Ohio.

Safety Equipment

Air Purifier—Absorbs fumes and removes oil and moisture from compressed air so that pure air is delivered to operator's mask during sandblasting operations. Motor Improvements, Inc., 365 Frelinghuysen Ave., Newark, N. J.

Respirator — For protection against lead and Type A dusts, and mists en-

Equipment Machinery Materials Supplies

countered in chromium plating and spray painting. Filter medium is felt screen backed by cellulose filter. Mine Safety Appliances Co., North Braddock St., Pittsburgh.

Textile

Fabric-Shrinkage Tester—Tests susceptibility to shrinkage of fabrics upon dry cleaning. Consists of 3-gal. barrel which is rotated first in one direction, then in the other. Albert Weiss, 151 West 21st St., New York.

Fabric-Wear Testing Machine—Polished steel shoe and platen. Shoe oscillates continuously over 7-in.-square sample. Wear is automatically recorded on chart every 20 min. Vacuum cleaner removes grit and lint continuously. Shawmut Engineering Co., 195 Freeport St., Boston.

Reflection Meter—Photo-electric. For objective determination of whiteness. Photo-electric cell is separate unit with extension cord. Portable. Pfaltz & Bauer, Inc., 300 Pearl St., New York.

Water-Spray Gun — For spraying water on fabrics to be pressed. "Thor-Tex." Both air and water can be controlled. Binks Mfg. Co., 3114 Carroll Ave., Chicago.

Tools and Supplies

Air Nozzle—Straight air nozzle for ⅜- or ½-in. hose. Male hose tip cast integral with body. Brass handle. H. B. Sherman Mfg. Co., Battle Creek, Mich.

Blow-Torch — Has acetylene generator. One filling of water sufficient for 3 charges of carbide which is placed in special drawer. Torch has needle regulating valve. Reimer & Campbell, Inc., Lafayette St., New York.

Cap Nuts—Cold forged cap nuts. Base of nut is faced off and corners chamfered. Brass finish, but can be had plated. Parker-Kalon Corp., 200 Varick St., New York.

Ladder—Combination stepladder that can be opened out to form a straight ladder. The Goshen Mfg. Co., Goshen, Ind.

Welding and Cutting

Welder—Spot welding machine. Lower arm can be swiveled, raised, or lowered. Foot valve lowers head, and closes switch if depressed to its limit. Stroke adjustable from 0-5 in. Pressures, 200-5,000 lb. Heating range, 64 points. Thomson-Gibb Electric Welding Co., Pleasant St., Lynn, Mass.

Wire and Wiring Devices

Conductor Clamps—"Hi-Lite." High strength and light weight. Six sizes. Ohio Brass Co., Mansfield, Ohio.

Connector — Solderless. Bronze; for outdoor applications. Holds two No. 12 or three No. 14 wires in either end. H. B. Sherman Mfg. Co., Battle Creek, Mich.

Hot Wire Clamp—Fits Nos. 8-0 conductors; tap wire is No. 6. Clamp of manganese bronze; large contact surface. Line Material Co., South Milwaukee.

Outlet Box Receptable—Three-wire; 15-amp. Mounted on 4-in. cadmium plated box cover. No. 9121. Bryant Electric Co., Bridgeport, Conn.

Woodworking

Sanding Machine — Six-inch sanding belt is driven over work placed in sanding table. Belt travels over two wheels 10 in. in diameter, one of which is motor driven. Working surfaces can be 36 or 60 in. long. W. B. & J. E. Boice, Norwood Ave., Toledo.

TRADE LITERATURE

ALLOY STEELS—Booklet, title "Agathon Alloy Steels."—Republic Steel Corp., Massillon, Ohio.

BELT DRIVES—Bulletin L-400-B7, on Multiple V-Belt Drives with Emerald Cord belts.—Worthington Pump and Machinery Corp., Harrison, N. J.

BUSBAR FITTINGS—Price list No. 3, covering busbar and conductor fittings; price list No. 31-B-1, on indoor bus supports and insulator cable supports.—Delta-Star Electric Co., 2400 Block, Fulton St., Chicago.

CASTINGS—Chart, showing causes and remedies for defects in castings.—Harry W. Dietert Co., 676 West Grand Blvd., Detroit.

CONTROLLER—Bulletin GEA-2100, describing collector for battery trucks.—General Electric Co., Schenectady, N. Y.

DIESEL GENERATORS—Form 3105, describing diesel generator sets.—Caterpillar Tractor Co., Peoria, Ill.

DUST COLLECTOR — Brochure, on "Froth-Filtration" dust collectors.—The C. O. Bartlett & Snow Co., Cleveland.

ELECTRIC DRILLS—Two folders, on electric drills for metal and wood.—The Temco Electric Motor Co., Leipsic, Ohio.

ELECTRIC GRINDERS—Folder, on line of electric grinders.—The Temco Electric Motor Co., Leipsic, Ohio.

FEEDWATER HEATERS—Bulletin W-210-B19, on stationary feedwater heaters.—Worthington Pump and Machinery Corp., Harrison, N. J.

GAS GENERATORS—Bulletin 100-B12, on Harrison inert gas producers.—Root-Connersville Blower Corp., Connersville Ind.

GEARS — Reprint of article on worm gears.—De Laval Steam Turbine Co., Trenton, N. J.

INSTRUMENTS—Publication 2246, on boiler instruments, combustion control, and flowmeters.—The Hays Corp., Michigan City, Ind.; Carrick Engineering Co., Michigan City, Ind.; and Cochran Corp., Philadelphia.

LEATHER PACKINGS—Leaflet, describing Tannate leather packings. — J. E. Rhoads & Sons, 35 North 6th St., Philadelphia.

LIGHTING EQUIPMENT—Bulletin No. 956, on Gould-Westinghouse emergency lighting equipment.—Gould Storage Battery Corp., Depew, N. Y.

LIGHTING FIXTURES — Supplement Section XI-A to Calalog No. 26, on high intensity mercury vapor lamp fixtures.—Benjamin Electric Mfg. Co., Des Plaines, Ill.

MEASURING INSTRUMENT — Leaflet, announcing indicator Model 95 for use on mechanical measuring instruments.—Federal Products Corp., Providence, R. I.

METAL MARKER—Folder, describing Electro-Graphic Graver for marking any type of metal.—The Electro-Graphic Graver Co., Toledo, Ohio.

PUMPS—Bulletin W-450-B27, on deep well turbine pumps.—Worthington Pump and Machinery Corp., Harrison, N. J.

ROOFING—Folder, giving information on Longlife asphalt roofing.—Flexrock Co., 800 North Delaware Ave., Philadelphia.

RUBBER GOODS — Second edition of general catalog, describing belting, hose, packing, rubber coverings, abrasive wheels, etc.—The Manhattan Rubber Mfg. Division of Raybestos-Manhattan, Inc., Passaic, N. J.

SANDERS AND POLISHERS — Folder, on electrically driven sanding and polishing machines.—The Nedco Co., Natick, Mass.

SHEAVES—Bulletin 2188A, on Duro-Brace Texsteel Sheaves.—Allis-Chalmers Mfg. Co., Milwaukee.

SPEED REDUCER—Catalog 2055-37, on heavy duty, worm-gear speed reducer.—Bodine Electric Co., 2264 West Ohio St., Chicago.

STEAM DISTRIBUTION — Catalog No. 35, giving engineering and price data on complete line of steam distribution equipment.—American District Steam Co., North Tonawanda, N. Y.

STEAM TURBINES—Booklet GEA-1145C, on steam turbines for mechanical drive.—General Electric Co., Schenectady, N. Y.

STOKER—Catalog No. C-5, on Coxe traveling grate stoker.—Combustion Engineering Co., Inc., 200 Madison Ave., New York.

TACHOMETERS—Bulletin No. 935, on electrical tachometers for speed measurement.—The Esterline-Angus Co., Indianapolis, Ind.

TANTALUM—Booklet, on properties and uses of tantalum.—Fansteel Metallurgical Corp., North Chicago.

TELEPHONE BOOTH—Leaflet, describing acoustically treated telephone booth.—Burgess Battery Co., Madison, Wis.

THERMOMETER — Folder, describing Ideal Tel-Temp, a thermometer for use on motors.—Ideal Commutator Dresser Co., Sycamore, Ill.

TRANSFORMERS — Catalog sheet 351-MV, describing transformers and reactors for mercury vapor lamps.—Jefferson Electric Co., Bellwood, Ill.

VALVES—Folder, on throttling and relief valves.—The Edward Valve & Mfg. Co., Inc., East Chicago, Ind.

VARIABLE SPEED TRANSMISSION—Book No. 1374, on V.R.D. self-adjusting variable speed transmission. — Link-Belt Co., 2045 West Hunting Park Ave., Philadelphia.

VARIABLE SPEED TRANSMISSION—Book No. 1574, on P.I.V. Gear.—Link-Belt Co., 2045 West Hunting Park Ave., Philadelphia.

VIBRATION DAMPER — Leaflet, on Type-T Seismo-Damper for vibration damping.—The Korfund Co., Inc., 4815 32d Pl., Long Island City, N. Y.

VIBRATION DAMPING — Booklet, title "A Study of Vibration in Plant Machinery," describing use of felt for vibration isolation.—The Felters Co., Inc., 210 South St., Boston.

WATER METER—Bulletin M-975-B30, on "Watch Dog" disk water meter, Style 2, sizes 1½ and 2 in.—Worthington-Gamon Meter Co., Harrison, N. J.

WIRE ROPE—Catalog G-11, on line of wire rope.—Macwhyte Co., Kenosha, Wis.

Always on Schedule

(Continued from editorial page 57)

ample, to change each felt or four hours to install a new Fourdrinier wire. On the other hand, the delay allowance may not be used up. Consequently the schedule may be off three or four hours either way at the end of the week, and this delay will have to be absorbed by changing the subsequent schedule, by inserting a run of the right length, or by taking out a stock run or order that is not urgent.

Orders are given to the mill 24 to 36 hours in advance, this being all the notice required, although the superintendent does keep himself familiarized in a general way with what to expect for the next week or more.

No difficulties have been experienced in operating the new plan, although it was a big job to get it started. At that time so many orders were on hand that it was quite a task to get the tickets prepared and at the same time keep up the routine.

Not only has the plan to a large extent eliminated the irregularities that resulted from the previous incomplete scheduling, but it has also enabled the company to plan the purchasing of special pulps and other materials well in advance so that they will be on hand when required. The flexibility and simplicity of the method of setting up the job cards into a schedule permits innumerable combinations and sequences to be studied and laid out to give the best possible operation. At the same time it is easy to change these sequences, should the uncontrollable variables inseparable from paper making so require.

•

Depreciation Dollars

(Continued from editorial page 69)

obvious result is that these concerns cannot maintain buildings and equipment in prime condition and are forced to use outworn, antiquated facilities long past their normally useful period.

Go into any long-established industrial community and you will observe buildings so ancient in design and so inadequate in regard to modern requirements of sanitation, safety, and appearance that you

DeVilbiss Equipment
Spray-Finishes
U. S. Playing Cards

● There seems to be almost no end to the unusual applications of DeVilbiss Spray-Finishing Equipment. You will find it helping in the manufacture of everything from buttons to battleships. And right where you might least expect it—in the huge plant of the U. S. Playing Card Company in Cincinnati, special DeVilbiss machines put the "finishing touch" on grand slams in the making... Perhaps you have an operation which might be simplified by the installation of standard or specially designed DeVilbiss Equipment. Our engineers will be glad to advise you.

THE DEVILBISS COMPANY · TOLEDO · OHIO

New York · Philadelphia · Cleveland
Detroit · Chicago · St. Louis
San Francisco · Windsor, Ontario

Direct sales and service representatives available everywhere

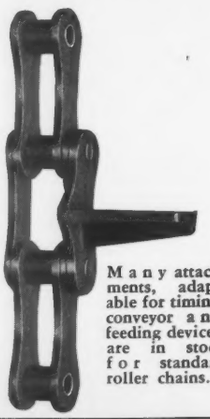
DeVilbiss

This chain DELIVERS!

Call to mind every ideal feature that you ever visioned for positive power transmission or conveying systems—load capacity—speeds up to 4,000 R.P.M.—quiet operation—low initial cost and upkeep. In each of these, Baldwin-Duckworth machine-finish roller chains deliver maximum service with unparalleled efficiency and endurance.

Modernize now with Baldwin-Duckworth roller chains and accurate-cut sprockets. Our catalog and engineering advisory service is yours for the asking. Baldwin-Duckworth Chain Corporation, Springfield, Mass.

BALDWIN-DUCKWORTH



Many attachments, adaptable for timing, conveyor and feeding devices, are in stock for standard roller chains.

100 uses for VACUUM in industry

Here are a few Spencer applications: Cleaning barrels, box cars, shipping rooms and products before shipment; keeping work rooms clean in tea, spice, watch and radio factories.

Removing excess sand, soap, starch, lead, fertilizer, wood and paper that accumulates during the process of production.

Holding lithographic negatives, lifting paper for sorting, cleaning brass sheets, removing sand from doors, color materials from machines, armature chips and coal dust.

If your dirt or dust problem is not mentioned above, we would like to hear from you.

Spencer Central and Portable Vacuum Cleaning Systems are solving scores of new problems every year. Also they reduce industrial floor cleaning costs. Bulletin on request.

SPENCER HARTFORD CENTRAL AND PORTABLE VACUUM CLEANING SYSTEMS

THE SPENCER TURBINE COMPANY, HARTFORD, CONN.

51

wonder why they continue to be used.

There is no excuse for their continued existence as eyesores and menaces to health and safety, except that the owners lack the funds for their reconstruction.

Why do they lack these funds? Let's assume that the buildings were erected 50 years ago; that depreciation has been charged at 4 per cent, a quite common rate. If such depreciation had actually been reserved, the owners would have ample funds available with which to replace old buildings with modern structures of greater value, even if they had used some of the depreciation reserves to modernize the old structures from time to time.

But no, they have no such funds. They have sold their goods at prices that did not permit them to collect adequate depreciation funds. They may have dissipated such funds by unwise application to operating costs, possibly to dividends.

The public has been defrauded to the extent that it is obliged to tolerate the old structures. Stockholders and owners have been defrauded in the shrinkage of values in their assets.

(In March, a second article on "Depreciation Dollars" will point out how the Federal Government could easily bring home to industrial executives the importance of recognizing the reality of depreciation reserves.—Ed.)

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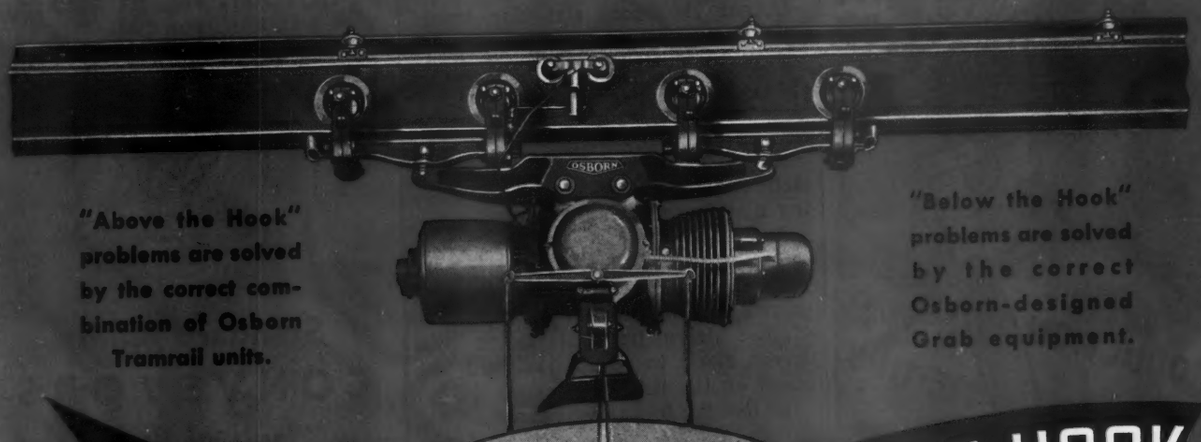
Gearing Series Motors

(Continued from editorial page 76)

a given acceleration period where the car is accelerated to 500 f.p.m. from rest. This is an average of $(62 + 11.7) \div 2 = 36.8$ amp. during the acceleration period.

Using the 6.8-to-1 ratio the current is reduced from 62 amp. to a value corresponding to $(1{,}060 \times 500) \div 737 = 720$ r.p.m. The current corresponding to 720 r.p.m. is 42.5 amp., or an average of $(62 + 42.5) \div 2 = 52.3$ amp. Obviously, if the car runs on a fast duty cycle where acceleration periods predominate, the motor will show the effect of carrying this 42 per cent increase in current. Since the heat generated varies as the square of the current, it is easily possible for a series-wound motor of the correct size to be burned out on a fast duty cycle because of improper gear ratio, as



"Above the Hook" problems are solved by the correct combination of Osborn Tramrail units.

"Below the Hook" problems are solved by the correct Osborn-designed Grab equipment.

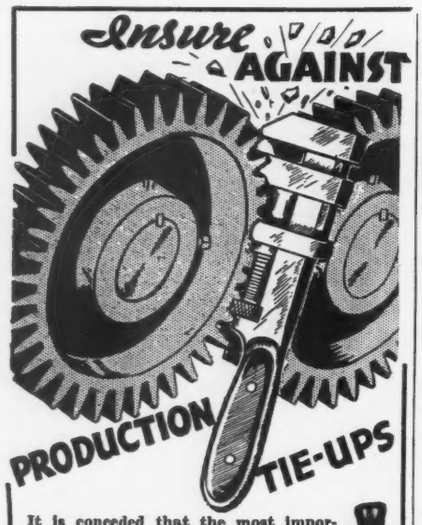
ABOVE AND BELOW THE HOOK

Materials are handled more efficiently and economically with

OSBORN

TRAMRAIL SYSTEMS

THE OSBORN MANUFACTURING COMPANY • 5401 HAMILTON AVENUE • CLEVELAND, OHIO, U. S. A.



It is conceded that the most important tool on the assembly line is the soldering iron. Time lost due to faulty, slow heating, clumsy irons can be translated into dollars lost.

You can now insure yourself against production difficulties by using ESICO electric soldering irons.

Sturdily constructed—for quick efficient production work, the Esico soldering iron is a short cut to reducing maintenance and production costs.

Available in six convenient sizes at all Esico Hardware and Mill Supply distributors.

Electric Soldering Iron Co., Inc.
342 West 14th St., New York, N. Y.

ESICO
REG. U.S. PAT. OFF.

WIRE

Round—Flat—Half Round
Straightened and Cut Shape Wire

HIGH CARBON SPRING
LOW CARBON BASIC AND BESSEMER OIL TEMPERED
WELDING WIRE RODS AND COILS

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Sizes ½" to No. 40 WM Gauge (.007)—All Finishes

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Wire for Practically All Purposes and Requirements also SCREEN WIRE CLOTH

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Highest Quality and Service Guaranteed

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IRON STEEL WIRE "SENECA" QUALITY TRADE MARK

The Seneca Wire & Mfg. Company
Fostoria, Ohio
Representatives and Warehouses in practically all principal cities

well as be unable to make the schedule required.

About the same situation would prevail if an automobile were required to start and stop every few feet when locked in high gear. If in low gear, it could operate on such a schedule with ease.

It is evident that the following steps should be followed when applying a series motor to a drive:

1. Calculate the speed required of the driven shaft or axle.

2. Calculate the horsepower required and divide by the efficiency of the drive between motor and driven shaft to obtain the load imposed on the motor.

3. Refer to the characteristic curves of the motor and find the correct motor speed corresponding to the motor load calculated under 2.

4. Divide the speed of the motor found under 3 by the speed of the driven shaft calculated under 1. This will give the correct gear ratio or speed reduction between the motor pinion and the driven shaft or axle.

If it happens that the load imposed by the drive coincides with the full-load horsepower rating of the motor, the rated speed can be used when figuring the gear ratio.

Probably the reason errors are made in gearing series motors is because they are in less common use than the shunt-wound type or general-purpose induction motors, which run at practically the same speed at all loads and therefore make the calculation of gear ratio between the motor and the drive a simple matter.

If series motors run hot on fast-duty-cycle work, a change in their gear ratios may make them run cooler.

•

Filing Maintenance Data

(Continued from editorial page 74)

will have the letter G. This G is assigned to all foreign drawings regardless of size.

For each outside drawing, two separate cards are made out. The first card is made out in the manner described for drawings made by the plant engineer's office, and put in the card file. The second card, of different form, is filed under the manufacturer's name. This card shows the manufacturer's drawing number and the new number assigned for filing, the title of the drawing, the date and number of copies received

OVERCOATS FOR ELEPHANTS —LEGGINS FOR CANARIES

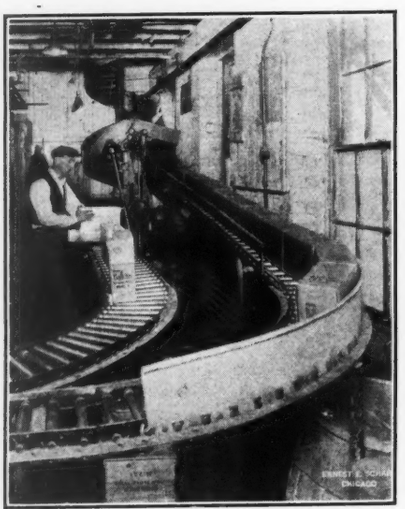
Standard Builds CONVEYORS for Plants of Every Size

Many of America's largest industrial plants are Standard-equipped from one end to the other. And there are little shops that use only a single length of Standard conveyor.

No matter how big or how small your conveyor requirements may be, Standard can meet them. They place at your command 30 years of experience and a complete line of conveyors.

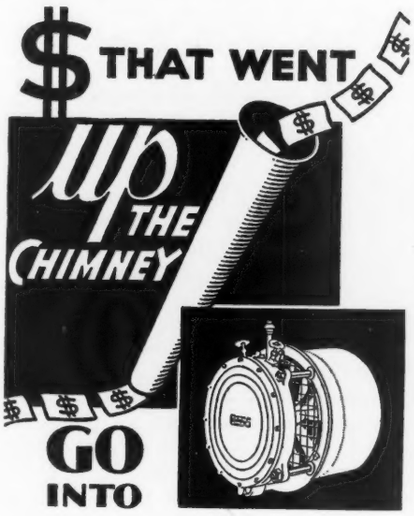
Call in a Standard engineer on any conveying problem or write for literature covering your industry.

STANDARD SALES AND SERVICE IN ALL PRINCIPAL CITIES. CALL THE OFFICE NEAREST YOU.



Conveyors by STANDARD are Standard of Industry

STANDARD
CONVEYOR COMPANY
112 INDIANA AVENUE
NORTH ST. PAUL, MINNESOTA

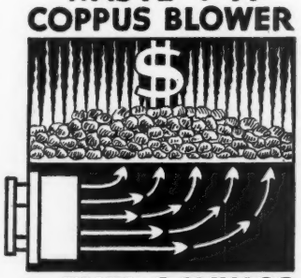


PROFITS WITH A COPPUS BLOWER

You stop paying out large sums for fuel the moment you install a Coppus Forced Draft Blower. Its extra draft under the fire produces generous, steady heat from buckwheat coal, coke breeze, sawdust, yard screenings, tan bark, shavings, and all kinds of refuse.

Often you can do even better than buying cheaper fuel—you can stop buying *any*, and use waste you formerly threw away. Write for Bulletin 145-5, on Type C, steam turbine drive. Bulletin 148-2 describes special electric motor blowers.

WASTE + A COPPUS BLOWER



= FUEL SAVINGS

COPPUS ENGINEERING CORPORATION

375 Park Ave., Worcester, Mass.

Sales Offices and Distributors listed in THOMAS' REGISTER

IN SWEET'S also BLOWERS AIR FILTERS HEAT KILLERS STEAM TURBINES

3316

and their disposition; whether they were sent back to the manufacturer approved or disapproved. If the drawings were disapproved and resubmitted, the necessary information is filled in for each successive submission.

There are also other uses to which the first panel is put. Specifications receive a six-part number, like that for drawings, but the first panel contains an S. Lists of renewal parts carry the letter R and instruction books carry the designation T.

With cards made out and all drawings and data numbered, the document file is ready for assembly. Leters R, S, and T are filed separately, although this is not necessary. All other material is folded to letter size and filed behind manila guides bearing the six part file number.

Here there is a slight change in the method from that used in filing the cards. Drawings are first filed in accordance with the second panel, bringing all the drawings on one building together, noting that drawings from outside as well as the company's own are filed together. Once filed according to buildings, the drawings are arranged either under general, or successively in the order of floor, department, classification, serial number and drawing size.

No Hunting

The first purpose of this system is to enable a person to go directly to the file for information. Knowing in general what a drawing is about, or what building it is connected with, it is possible to segregate it to a very small space in the file, and by looking at a very few adjacent drawings, find the drawing wanted and get the desired information.

Correspondence is filed in similar manner, only a four-part number is used. Here, however, considerable material regarding contemplated work often accumulates and must be cared for. At the beginning of the article, "projects" were mentioned as having assigned numbers. This project number is used in the first panel of the four part number, the building number in the second panel, department number in the third, and class of work in the fourth and last panel. Each item of correspondence then has a four-part number jotted on the right-hand upper corner, to designate its place in the file.

All catalogs are filed, according to the A.I.A. pattern, in a separate division.

FOR SMALL H.P. TURBINE JOBS

Every elephant-size turbine is a white elephant on jobs requiring low H.P. A horse-size turbine will fit the job, saving you the difference in investment.

Coppus, virtually alone, offers

Six right-priced sizes up to 150 H.P.,

dark horses to you, perhaps, but every user says they come through.

Coppus turbines can be used in explosive atmospheres—no danger of sparking. Their speed range is wide—no burn-outs when over-loaded.

They also eliminate need for speed reducing devices, being the only steam turbines on the market with a

Built-In Speed Reducer

making low speeds possible with real economy.

Work this cost-cutting unit into your power plans. Bulletin 135-8 gives all the facts—write for it.

COPPUS ENGINEERING CORPORATION

375 Park Ave., Worcester, Mass.

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IN SWEET'S also BLOWERS AIR FILTERS HEAT KILLERS STEAM TURBINES

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Records of hundreds of installations of Standard New Process Duplicators show savings as high as 65%. Some are single machines in small offices and factories. Others comprise batteries of 8, 10, 12 or more, in giant corporations. And whatever the application — for forms, intricate systems, or general duplicating — the savings of the New Process method are inevitable.

Copies Direct From The Original

Standard's New Process method eliminates costly, time-consuming operations between typing the original master and making copies. It gives you direct action. Banishes gelatin, stencils, ink and type. Masters may be filed and used again. Because of these and other exclusive advantages, the scope of many established "systems" may be extended, and efficient systems established, not possible with previous methods.

How Users Save Money

General Motors Export Co., New York

Eliminates carbon manifolding and possibility of error in order-invoice work. Produces better copies in accurate registration. Savings in time and money warranted purchase of additional machines.

R. C. A. Victor Co., Camden, N. J.

Standard New Process Duplicators in various departments save many thousands of dollars annually in time, labor, and operating costs. Have also improved operating efficiency, speeded production work, and reduced possibility of errors.

American Forging & Socket Co., Pontiac, Mich.

Previously typed two masters — one for original order and one for completed job, with final labor, material and rate revision figures. By re-using original "master," re-typing and re-checking are eliminated, quality of copies improved, speed increased 30%.

MAIL COUPON TODAY!

Duplicating Machines Division,
Standard Mailing Machines Co.,
1935 Parkway, Everett, Mass.

Please send me more complete information how the New Process Duplicator reduces form costs up to 65%.

Name_____ Title_____

Company_____

Address_____

STANDARD *New Process* DUPLICATORS

People Who Work in Glass Houses

(Continued from editorial page 79)

This requires 175 gal. per min. of cooling water at a temperature of 53 deg. F. Wells driven on the company's property immediately adjacent to the building supply this water. It has been estimated that the sensible cooling load on the conditioned space will be 509,000 B.t.u.'s per hour. This will consist of (1) transmission heat gain, (2) sun effect gain, and (3) the gain due to the operation of 25¼ hp. in motors. Added to this is (4) a factor to take care of the 140 occupants of the building and (5) the heat liberated by two blueprint machines.

To maintain a temperature of 70 deg. F. inside the laboratory when it is 10 below zero outside, it is estimated that the heat loss will be 791,500 B.t.u.'s per hour. If the air conditioning equipment is handling 12,000 cu.ft. per min. of fresh air, it is estimated the steam requirements of the heating coils and of the heater for the spray humidifier will be approximately 2,000 lb. of steam per hour. If, however, only 5,000 cu.ft. per min. of outside air is admitted to compensate for that exhausted under such periods of operation, steam requirements will drop to approximately 1,400 lb. per hour.

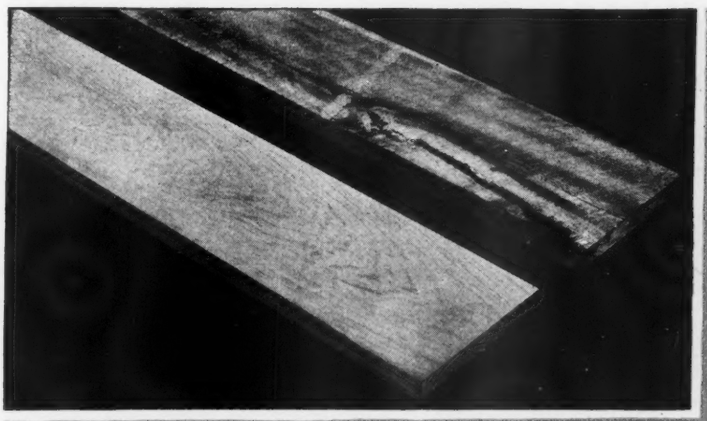
In Winter

For winter heating, the air-delivery temperature will be varied in accordance with the outside temperature. Incorporated in the control is a static-pressure regulator which will vary the volume of conditioned air handled in accordance with the aggregate demand of the various zones.

The air conditioning plant consists essentially of (1) a Clarage conditioning unit, (2) fans, (3) Aerofin booster heater sections, (4) a complete array of Johnson pneumatic temperature and humidity controls, (5) a system of main and secondary ducts, and (6) glass-wool baseboard dust stops.

Having a capacity of 26,000 cu.ft. per min., the centrally located conditioning unit (second floor, front) consists of twelve 30x72-in. two-row coils, arranged three high and four deep, complete with an 8-in. eliminator assembly, humidifying spray, spray nozzles and drain.

The main fan is a multi-blade unit with a capacity of 26,000 cu.ft. per min. at 1½-in. static pressure,



. . . LUMBER FREE FROM WEAKENING IMPERFECTIONS SELLS AT A PREMIUM

It is carefully sorted and graded — the strong, straight grained lumber always costs more.

IF FITTINGS WERE GRADED LIKE LUMBER

you would pay more for Grinnell Air Furnace Malleable Iron Fittings

The use of the finest raw materials; the superior *Air Furnace* process of producing malleable iron; the care and exactitude in manufacturing processes and subsequent three-fold inspection, combine to make Grinnell *Air Furnace* Malleable Iron Fittings the finest malleable iron fittings to be had.

Yet They Cost No More Than Other Malleable Iron Fittings

Freedom from sand holes and other weakening imperfections increase their strength and eliminate leakage troubles. Proper chamfers insure easy starting. Clean accurate threads make airtight joints. Smooth cores allow free flow.

Yet They Cost No More Than Other Malleable Iron Fittings

GRINNELL COMPANY INC.

EXECUTIVE OFFICES PROVIDENCE, R. I.

Branch Offices in Principal Cities

GRINNELL AIR FURNACE MALLEABLE IRON FITTINGS

For faster installation with resulting saving in cost, standardize on

GRINNELL AIR FURNACE MALLEABLE IRON FITTINGS

To "up" prices in the face of limited buying power and keen competition is hazardous. Yet, added taxes and increased costs on every side may force you to consider this step.

But before you decide that higher price provides the only solution—let us show you how you can find a better answer *in your plant.* By transforming existing factory waste into profit, MODERN LAMSON CONVEYORS effect vital manufacturing economies. LAMSON CONVEYORS release men for "pay-work"; shorten the manufacturing interval; reduce inventories; gear the flow of production to your modern high-speed machines, allowing you to take full advantage of machine speed. Here is a definite tool to reduce costs—and make higher prices unnecessary.

Even with limited production you can take advantage of the cost-reducing operation of MODERN LAMSON CONVEYORS. In fact, limited production makes the adoption of modern conveyors vital if profits are to be produced.

LAMSON brings to your problem many years of broad experience and many types of conveyors and handling devices. Now, while your "conveyor dollar" goes further, let us show you what LAMSON CONVEYORS can accomplish in your plant.

LAMSON *CONVEYORS*

FROM A 10-FOOT GRAVITY SECTION
TO A COMPLETE SYSTEM

THE LAMSON COMPANY • SYRACUSE, N.Y.

Yes, I'm interested in finding out if you can cut our production costs. Send your Book, without obligation.

NAME .....

COMPANY .....

ADDRESS .....

when operating at 223 r.p.m., and requires 8.7 hp. to drive. Its outlet velocity is 1,500 ft. per min. The fan is mounted on a sound-insulated base, and driven through a V-belt by a 10-hp., 1,200-r.p.m. motor.

A smaller fan delivers 1,300 cu.ft. per min. to the five private offices. Similarly mounted on a sound-deadened base, it is driven by a ½-hp. motor.

Booster heater sections are located in the branch ducts to the private offices. A separate exhaust system has been provided for the washrooms, each unit handling 710 cu.ft. per min. at ¼-in. static pressure, and driven by means of ⅛-hp., 1,150-r.p.m. motors.

Summer-Winter Control

Seven summer-winter room thermostats, each operating an automatic volume damper, control the volume of air admitted to the seven zones, exclusive of the five private offices.

Five summer-winter room thermostats located in the private offices, operate individual diaphram steam valves located in the steam supply to the booster heater supplying that zone. During summer operation these thermostats will operate an equal number of volume dampers controlling the volume of conditioned air to be admitted. The thermostats are automatically changed from summer to winter control position by varying the main line air pressure to them from a centrally located master-control switch.

A main duct thermostat, located in the discharge of the private office supply fan, controls through a suitable summer-winter switch and two 18x12-in. automatic dampers the volume of outside and heated air taken by this fan to provide the required air delivery temperature to these spaces.

A static-pressure regulator operates the automatic control in the fan inlet, which as the duct dampers close reduces the volume of air handled by the system, decreases the cooling or heating requirements, and also the power required by the supply fan at such times. During summer operation, the same regulator controls the amount of cold water supplied to the cooling coils.

A remote, adjustable thermostat with two bulbs, one located in the discharge duct from the fan, and the other in the outside air and operating two 3-in. diaphram steam valves, automatically varies the temperature of the air delivered and thereby the heating effect provided by the heating coils as determined and required by the outside temperature. During winter operation,

Profitable modernization begins with FACTS!

● In your plans for improvements and modernization during 1936, reserve a front position for *Instrumentation*. An engineered system of automatic controllers, recorders, and indicators can be of tremendous help in ferreting out and eliminating hidden wastes.

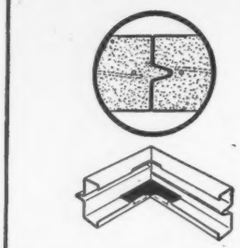
Call in a Foxboro engineer to investigate your processing problems—ask him to work out a way to give you full command of each temperature, pressure, flow, liquid level or humidity affecting your manufacturing. This is an *engineering service* we offer: a service that gives you advance knowledge of the amount of instrumentation you need and the results obtainable. For details, write directly to The Foxboro Company, 24 Neponset Ave., Foxboro, Mass.

FOXBORO

Complete
INSTRUMENTATION

A Plank Roof that is BETTER-THAN-WOOD

GYPSTEEL PLANK is a complete structural unit shaped like lumber. Made of extra dense, nailable gypsum. All four sides are bound with galvanized copper-bearing steel tongues and grooves which lock to form a strong, continuous I-BEAM. Center is reinforced with steel wire mesh. Vermin-proof, termite-proof, PLANK will not shrink or warp.



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GYPSTEEL Plank* gives you better-than-wood roof-deck construction at a cost that approximates and sometimes equals the cost of ordinary lumber. *Plank* is as easy to handle as wood, can be cut, sawed, nailed or bored with carpenter's tools, yet it has the strength — rigidity — permanence of a masonry material. Moreover, it provides a roof-deck with the same degree of fire-safety as the steel and masonry walls in the rest of your building. Remember the original cost is low, and you can save time, money, labor with the fast, simple installation features of *Plank*. Let us send you our Bulletin.

GYPSTEEL PLANK

AMERICAN CYANAMID & CHEMICAL CORPORATION
STRUCTURAL GYPSUM DIVISION
30 ROCKEFELLER PLAZA, NEW YORK, N. Y.

Gentlemen: Please send, without cost, your *Plank* Bulletin

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F.M.M. 2-36

for each 2-deg. rise or fall outside, the delivery temperature is reset 1 deg. as indicated below.

Outside Temperature	—10	10	30	50	70
Delivered Air Temperature	110	100	90	80	70

A two-point, reversing-type duct thermostat, located at the entrance to the Clarage unit, operates automatic fresh and return air dampers to allow the taking of outside air for cooling purposes, when the conditions are favorable, in place of using cold well water for cooling at such times.

An electro-pneumatic switch, interconnected in the fan motor circuit, opens a portion of the fresh air damper whenever the fan starts to provide a constant supply of outside air for ventilation and exhaust purposes. Similarly, a duct humidistat, located in the return air duct, works (during winter operation) a water-regulating valve controlling the water admitted to the humidifying spray to maintain the ideal condition.

The resistance of the glass block walls to heat loss by conduction or infiltration is expected to reduce the cost of maintenance for the air conditioning, and to provide the stablest possible working conditions for laboratory as well as offices.

•

Security—This Is More Like It

(Continued from editorial page 51)

proportionate burdens upon stockholders. Employees, on the other hand, will appreciate in advance that the company will be obliged to revise its contribution rates if the costs become excessive.

Essential differences between old and new plans are as follows:

1. The company no longer assumes an indefinite liability. At the end of each year its own obligations are completed with the contributions it has made out of current earnings. Responsibility for ultimate payments of annuities is taken over by insurance companies.

2. A retiring employee's pension will no longer be based on his earnings for the last five years of service. He will be entitled to the annuity purchased from the insurance company by his contributions plus the company's.

3. For many years to come, re-

THERE IS A RACKETEER IN YOUR PLANT!

There is a racketeer in your plant! . . . He steals your profits! . . . He throttles your machines! . . . He brings enforced idleness to your men! . . . He robs your products of quality!

His name . . . is WEAR!

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Wherever there is operating equipment in your plant you will find abrasive or corrosive wear taking its toll in delayed production, costly "down-time", expensive replacement costs, and "rejects" of parts produced.

Carboloy cemented carbide, a metal next to the diamond in hardness, frequently offers a simple inexpensive solution to the problem of wear on the operating parts of industrial equipment. You simply insert a small segment of Carboloy at the point of wear and the part is ready for increased life up to ***50 times greater*** than that of ordinary metals commonly used.

Carboloy is especially suitable for use on parts on which the area of wear is relatively small, such as on valve stems, cams, guides, contacts, work rests, dies, nozzles, bushings, gages, guide rolls, mechanical "fingers", trips, etc.

Send for 20-page booklet giving complete information.

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Company_____
Street_____
City_____ State_____

Salesman, in Sunday clothes, "outplumbs" 2 plumbers

Clears bad stoppage in waste line that defied combined efforts of both craftsmen

● **This is an actual occurrence**

In a factory building in a large midwestern city, a wash-room line became stopped up. Repeated efforts were made to clear the stoppage by all known methods. At one time *two* plumbers put their combined skill and strength into the job. Failing in their efforts they decided it was a tear-out—marble slabs, walls and floors.

The Power-Twist representative happened in just then. In about fifteen minutes he had cleared the stoppage. Five minutes later—still in his Sunday clothes—he walked down the street with an order for a Power-Twist Cleaner.

Write for complete information and prices.

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Waste Line Cleaner
The
Standard Appliance Corporation
209 Hickory St., Dayton, Ohio

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Take all the wear

IN every plant, in many machines, there are points where "Chicago Rawhide" Pinions will end destructive vibration and chatter, and silence nerve-racking noise.
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C MECHANICAL LEATHERS R

tiring employees may receive pensions from three sources—from the company because of annuity credits earned under the old plan, from the Federal Government under the old age pension law, and from an insurance company for annuities purchased under the new Thrift Plan.

4. Under the old plan, pensions were provided only for those who reached retirement age while still in company service. Under the new, the employee cannot lose his accumulated credit, carried with the insurance company, even though his company connection terminates before retirement.

5. Instead of using the same formula for everyone, the new plan allows the employee to "write his own security act." Beyond the protection afforded by the Federal old age plan, his security program becomes a matter of his own choice.

Provides for Special Needs, Too

Another point to be emphasized is that security under the Thrift Plan is not limited to old age comfort, or to protection against loss of employment or death. It also provides against special needs that may arise from time to time. Children must be educated. There may be sickness. There *will* be repairs, possibly new furniture. The new plan provides for such emergencies by allowing the subscriber to withdraw up to one-third of his own deposits and the company's regular contributions and half of all other credits in the fund except the company's provisional contribution.

It is impossible to illustrate exactly how the plan will work out in a typical case for the simple reason that there are no typical cases. The plan is too flexible for that.

For instance, a man enters the employ of the company. He is 30 years old. He gets, we'll say, $100 a month. How will he participate in the plan? And how much security will he be buying?

It all depends on his rate of contribution. If, for example, he elects to put 3 per cent of his earnings into the plan, the company matches it with a similar amount. If he elects to put the minimum amount into group annuities (equivalent to the company's regular contribution—in this case, 3 per cent), he will upon retirement at 65 get an annuity approximating 40 per cent of his government pension, and will also have in excess of a thousand dollars available for stock, other insurance, or withdrawals.

On the other hand, suppose he elects to put the maximum into group annuities—in this case, the

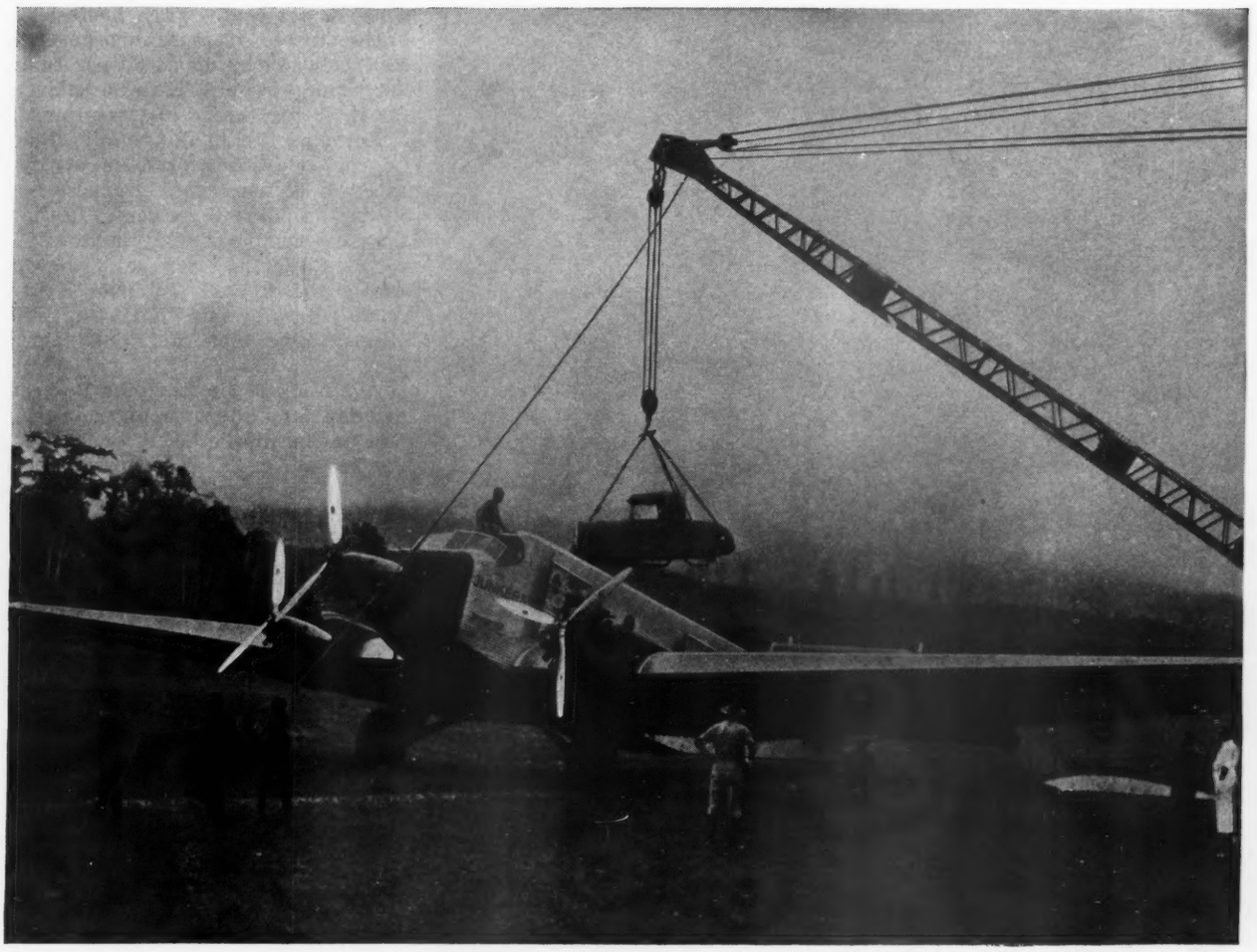
DON'T LET CHATTERING BRUSHES *make a monkey out of your motor*

Among the physical causes of brush chatter are wrong brush pressure, commutator out of round, high or low bars, etc.

Electrically, it may come from wrong brush grade or not running the machine up to rated load.

Our free booklet "The Brush Phase of Motor Maintenance" will help you determine whether to consult a brush manufacturer. *There's no obligation—just write.*

THE OHIO CARBON COMPANY
12508 BEREA ROAD CLEVELAND, OHIO



GUINEA GOLD FROM GOODRICH RUBBER

DEEP in the South Sea jungle of New Guinea, gold was found... But there was no way to bring it out—railroads were impossible and even roads were unheard of. Apparently the glittering wealth, even though known, was to remain just out of reach.

Then engineers of Bulolo Gold Dredging Co., Ltd., conceived the bold plan of flying machinery into the jungle, to extract the gold from the gravel so that only pure gold need be carried out. Rubber contributed to the success of the plan.

Goodrich makes a special rubber to line ball mills—great revolving cylinders which grind materials so that "pay dirt" can be separated. This Goodrich rubber resists the terrific abrasion of the grinding ore and outlasts the finest steel linings, formerly used for the purpose, sometimes as much as ten to one. And, of course, the Goodrich lining weighs only a fraction as much as steel.

So airplanes flew Goodrich rubber into the jungle, mills were set up, and the separated gold was flown out.

There's latent gold in many a product or process today—gold that Goodrich rubber, in its new forms and properties, might discover. Goodrich engineers have perfected rubber compounds which can be used to eliminate noise, reduce vibration, cut production costs, increase product life, or add the novelty of lightness, new color, shape or texture to your product.

Put these new properties of Goodrich rubber to work for you, as so many others are doing—to their profit. Write The B. F. Goodrich Co., Mechanical Rubber Goods Division, Akron, Ohio.

• Goodrich rotary drill hose, used in oil drilling stands the abrasion of mud at 800 to 1000 lbs. pressure per sq. in., and is more flexible and far cheaper than the steel pipe formerly used.

• Goodrich rubber bearings for marine propeller shafts outlast the finest wood or metal 4 to 12 times, protect the metal shaft from abrasion, and deliver more and smoother power.

• Stinging blows of sharp sand cut steel blast helmets in a few hours. Covered with Goodrich rubber by the Anode process, the same helmets last 10 to 20 times as long.

• Chutes handling sharp rock in mills and mines quickly wore out. Covered with Goodrich rubber, these chutes last 10 times as long, reduce production cost and shut-down time.

Goodrich

ALL *products problems* IN RUBBER

IT is a scientific fact that lamps marked with the GE monogram stay brighter longer than so-called cheap lamps. 480 checks and inspections in manufacture guard against the imperfections found in poor lamps—imperfections resulting in dollars wasted for current which is not converted into light.

General Electric's research and development have resulted in lamps of greatly improved efficiency and lower price. In the interest of better, more efficient work, you owe it to yourself, to your business associates, and to your employees to be sure that eyes are receiving adequate light for today's close seeing tasks . . . from lamps that *stay brighter longer*. For good light at low cost—for sight-saving light—always buy lamps with this mark GE.

GENERAL ELECTRIC
MAZDA LAMPS

General Electric manufactures lamps for home lighting and decoration, automobiles, flashlights, photography, stores, offices and factories, street lighting and signs. Also Sunlight lamps.

whole 6 per cent. Then he is able practically to increase his government pension by about 80 per cent, but would of course have no balance for the other things just mentioned.

However, this is all assuming that he continues to contribute at the rate of 3 per cent. Suppose he chooses to put in 8 per cent. In that case, the company rate jumps to 5½ per cent. Or let's say he is able to "shoot the works" and put 13 per cent of his pay into the fund. The company will then contribute 8 per cent.

Again there is the question of how much goes into group annuities, how much into other things. But say he puts in 13 per cent of his pay and elects to put the minimum amount into annuities. That, you will remember, is an amount equal to the company's regular contribution—in this case, 8 per cent. He will then on retirement have a total pension (including Federal old age) about equal to his regular monthly earnings, and in addition several thousand dollars balance for other purposes.

This, it is plain, is *more like social security.*

Exact figures have been purposely omitted from the foregoing argument for the simple reason that any "typical" case might be regarded as the "one best" solution for a given salary level and age. There is *no* one best solution. Each case must be figured out according to the employee's needs and wishes.

Further information concerning the Thrift Plan follows in convenient question-and-answer form; they are the sort of questions employees may be expected to ask about any pension plan.

Effective Date

1. *What is the effective date of the Employees' Thrift Plan?*
January 1, 1936.

Eligibility

2. *When will I be eligible to participate?*
On January 1, 1936, if you are at work on that date and credited with one or more years of service; otherwise on the day after you complete one year's service if then at work.

Participation

3. *Am I required to participate in the plan?*
No. Participation is voluntary.

4. *What must I do to become a participant?*
You must sign the payroll deduction and allotment authorization and beneficiary forms.

Contributions

5. *How much may I contribute?*
Any amount from 3 per cent to 13 per cent of your current compensation.

Less oil...

Less often...

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That's the simplest way of summing up what these phenomenal lubricants are accomplishing for industry. Their strong, tough film, their remarkable cohesion that makes them leak-resistant, and their high oiliness value makes them indeed deserve the slogan, "Less Oil, Less Often." ***Write for the Sta-Put Circular.***

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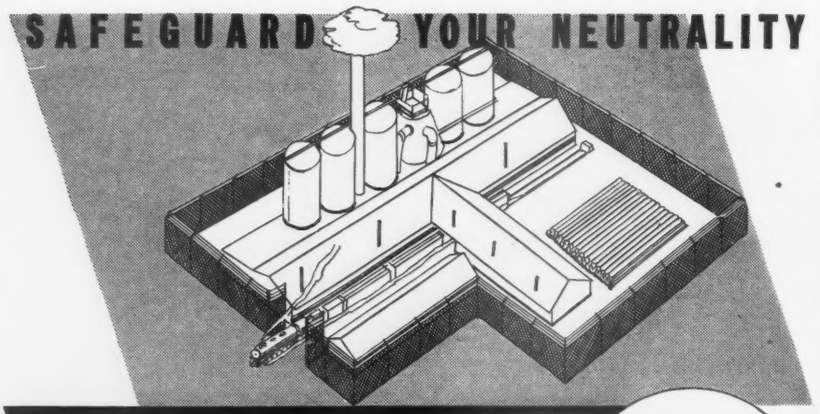

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They get around SHARP TURNS

WHERE space is confined and aisles narrow, industry turns to Bond for truck casters capable of swiveling "on a dime" under heavy or light loads. If restricted space slows stock-moving, put your trucks on the Bond swivel casters designed for your particular working conditions. See your Bond Distributor or write to us.

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MANHEIM, LANC. CO., PENNA.
PHILA. OFFICE: 617 ARCH ST. N. Y. C. OFFICE: 30 CHURCH ST.

6. *How much does the company add to my contributions?*
The company's rate of contribution depends on your own, as indicated by the table:

You contribute.	*Company contributes.*
3%	3%
4	3½
5	4
6	4½

7. *May I change the rate of my contributions from time to time?*
Yes, at the beginning of any future pay period.

Suspension of Contributions

8. *May I suspend contributions while in active service?*
Yes, upon written request, but such suspension will make you ineligible to resume for a period of one year.

9. *What are the rules covering contributions while on the inactive list?*
Your contributions must be suspended if you are on the inactive list, unless upon your request their continuance is approved.

Use of Fund Deposits

10. *What will be done with the money contributed by me and by the company under the Plan?*
It will be placed to your credit in a trust fund. You will allot a part of this money for the purchase of group annuities from the Equitable Life Assurance Society and The Prudential Insurance Company. You may use the balance to buy company stock or individual life insurance, or to pay dues in any approved mutual medical and hospital association. From time to time you may make withdrawals from any balance that still remains. Final settlement of your account will be made upon termination of service, death, or retirement.

Purchase of Group Annuities

11. *Must I make a regular allotment for group annuities?*
Yes, except that when you are credited with 30 years' service you may instruct the company to reduce such allotment to not less than 3 per cent or omit it entirely.

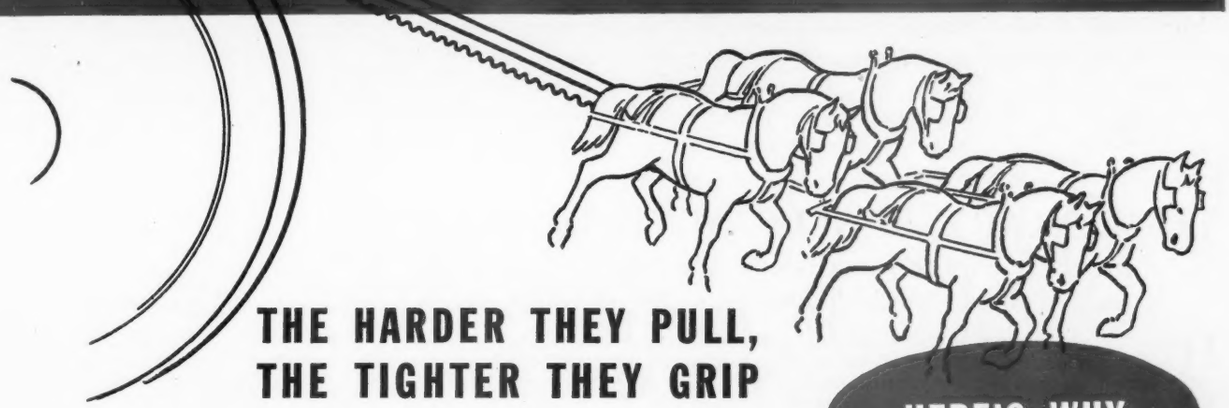
12. *Why does the Plan require me to make an allotment for group annuities?*
Because a portion of the money in your account should be permanently set aside for old age, and because a group annuity contract affords an advantageous method of securing old age protection.

13. *How much must I allot for group annuities?*
An amount not less than the company's regular contribution nor more than twice that amount; thus the total allotment from your account for group annuities may range from 3 per cent to 16 per cent of your pay.

14. *If I am receiving $100 per month and contribute $6 per month, what is the smallest amount I may allot for group annuities?*
If you contribute $6 per month, the company's regular contribution will be $4.50 per month. Since the amount allotted for group annuities may not be less than the company's regular contribution, $4.50 is the smallest amount which you may so allot; of

DAYTON COG-BELTS HAVE

TREMENDOUS PULLING POWER



THE HARDER THEY PULL, THE TIGHTER THEY GRIP

In thousands of industries, Dayton Cog-Belts are saving money and increasing production because they have patented, exclusive features found in no other belts.

Dayton's tremendous, sustained pulling power is the result of its positive wedging action in the pulley groove. It is the only die-cut belt with raw edges to form the driving surface.

The Dayton is the only belt with patented, laminated construction which gives maximum crosswise rigidity. There is no squashing in the pulley groove . . . no bulging and distortion. Dayton Cog-Belts have such leech-like gripping qualities that they insure a steady, uniform flow of power with less tension and less strain on bearings.

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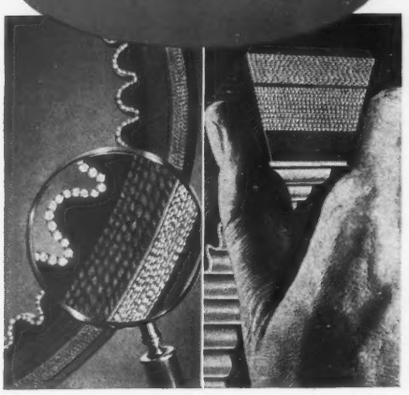
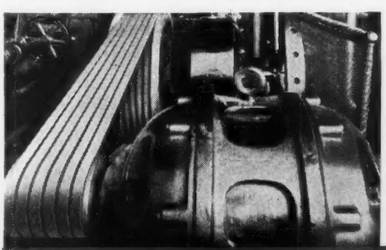
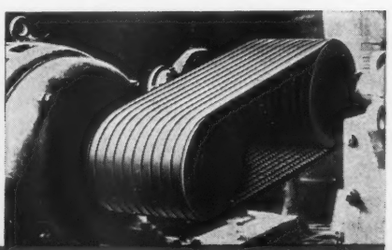


Die-Cut Sides and Crosswise Rigidity Provide Greater Traction





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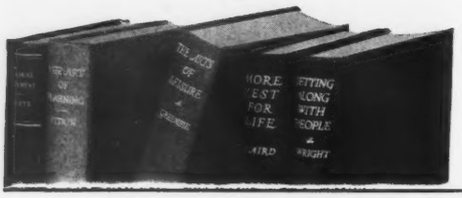
This is the greatest book on V-Belts ever published. It shows how Dayton Cog-Belts transmit more power, save space, last longer, and reduce costs. This important book will help you solve your drive problems. It's free. Write for a copy.



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makes clear the necessary elements of personal improvement and helps you to develop them.

HERE are five books that together form the first really comprehensive outline of the whole methodology of self development, the whole ART OF LIVING. They cover every factor you need to make your life full, forward-moving, enjoyable and successful. They knit these factors together in a complete program that will enable you to start benefiting from them at once. With hundreds of practical methods, pointers, tips, and suggestions, that you can apply, these books cover such subjects as:

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this $2.25 will be your money and $2.25 company money.

15. *If I am receiving $100 per month and contribute $6 per month, what is the largest amount I may allot for group annuities?*

Since the amount allotted for group annuities may not be more than twice the company's regular contribution, $9 is the largest amount which you may so allot; of this amount $4.50 will be your money and $4.50 company money.

16. *May I change the amount of my allotment for group annuities?*

Yes, at the beginning of any future pay period.

17. *Who will pay me my group annuity, and when will payments commence?*

The insurance companies will pay you your group annuity monthly. Payments ordinarily commence on the first of the month in which you become 65 years of age (women 55), but if the company retires you at an earlier age you may elect to have payments commence as soon as you retire but not earlier than age 55 (women 50). On earlier retirement, however, your annuity would have to be reduced because the insurance companies would normally expect to pay it over a greater number of years.

Type of Group Annuities

18. *What kind of annuity will I receive when I retire?*

A life annuity—i.e., one in which payments made to you as an annuitant cease upon your death.

19. *May I choose an annuity that provides some payment to my beneficiary after my death?*

You may choose:

(a) A modified cash refund annuity—in which, on your death, a single payment is made to your beneficiary in the amount, if any, by which the total of your own money allotted for group annuities, plus interest, exceeds the total of the group annuity payments.

(b) A modified joint and survivor annuity—in which monthly payments are made in half the amount after your death to your designated joint annuitant, as long as the latter survives.

(c) A joint and survivor annuity—in which the monthly payments previously made to you are continued in full after your death to your designated joint annuitant as long as the latter survives you.

Amount of Retirement Income

20. *How much group annuity will I receive if I participate in the Plan?*

The amount of your group annuity will depend on the total amount allotted for group annuities, your age at the time you enter the Plan, and your age at the time any change in the amount of allotments is made. Allotments made while you are young will earn more interest than those made at a later age; therefore, if you desire a large retirement income you should allot as much money for group annuities as circumstances permit and at earliest possible age, thus permitting greatest accumulation of interest.

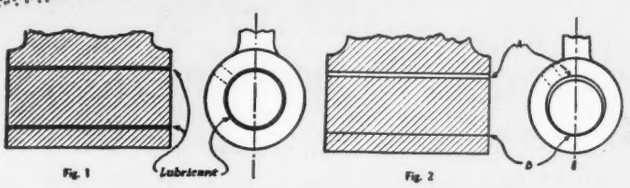
Purchase of Company Stock

21. *To what extent may I purchase stock prior to the date when I may make a withdrawal from the Fund?*

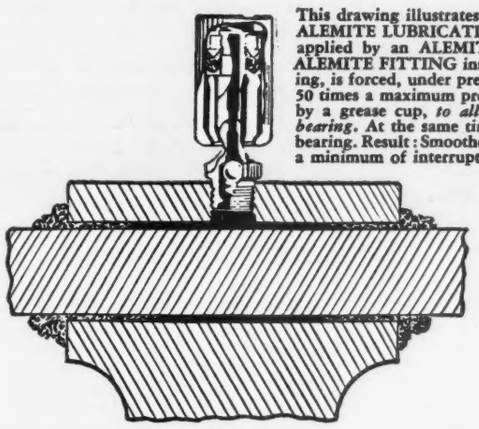
You may purchase stock prior to the date on which you may make a withdrawal provided there is a sufficient

Are your Bearings burning up MONEY?

WHY YOU NEED ALEMITE LUBRICATION:



Theoretically a properly lubricated shaft floats on a film of lubricant, as in Figure 1. However, if a bearing does not receive correct lubrication, metal-to-metal contact occurs (as in Figure 2). And the oil or grease at one point (for instance at "A") does no good at another point (for instance, "B") where friction and heat will develop to eventually necessitate replacement of the bearing.



This drawing illustrates the principle of ALEMITE LUBRICATION. Lubricant, applied by an ALEMITE GUN to an ALEMITE FITTING installed in a bearing, is forced, under pressure from 12 to 50 times a maximum pressure developed by a grease cup, *to all surfaces of the bearing*. At the same time it flushes the bearing. Result: Smoother operation with a minimum of interruption and repairs.

Alemite Lubrication Is Standard o Products of over 1000 Machiner Manufacturers Because It Provide POSITIVE LOW-COST LUBRICATIO

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Alemite Lubrication provides ample pressure to flush out bea ings. It introduces measured quantities of clean, fresh lubrica through leak-proof fittings. It prevents waste . . . closes the poin where the lubricant is introduced, thereby keeping out substanc which might score the bearings.

And Alemite Systems are easy to operate, and prevent ove lubrication and resulting oil drippage and contamination of t manufactured product. And Alemite permits safe lubricati while machinery is in operation, for the operator's hand is alwa a safe distance from moving parts. And by reducing starti torque, Alemite cuts power loss.

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amount of your own money in the Fund. The smallest number of shares you can buy at any one time will depend on the market price of stock and rules governing such purchases.

22. *To what extent may I purchase stock after I am permitted to make a withdrawal from the Fund?*

The answer to this question is the same as the answer to Question 21, except that you may also use company contributions in your account.

Purchase of Insurance

23. *What kind of insurance may I purchase under the Plan?*

You may purchase single-premium endowment or single-premium whole life insurance.

24. *What is the smallest amount of insurance I can buy?*

The amount will depend upon the rules of the insurance company issuing the policy.

Medical and Hospital Associations

25. *May I make an allotment for medical and hospital association dues?*

Yes.

26. *Why should I pay my dues in a medical and hospital association through the Fund?*

By paying dues out of your account in the Fund you are able indirectly to apply for this purpose some of the company's contributions.

Withdrawals While in Service

27. *May I withdraw any money from the Fund while remaining in the service?*

Yes, if your balance permits.

28. *May any part of my money allotted for group annuities be withdrawn while I remain in the service?*

No.

Liquidation of Account in Fund

29. *What happens to my account in the Fund if I die while in the service?*

The balance, exclusive of individual life insurance contracts, will be paid according to law, subject to settlement for any indebtedness to the Fund or the company.

30. *What happens to my account in the Fund if I leave the service prior to retirement?*

Your credit balance, including stock and insurance contracts purchased under the Plan and held for your account in the Fund, will be returned to you subject to settlement for any indebtedness to the Fund or the company.

Liquidation of Account with Insurance Companies

31. *What happens to my group annuities if I die while in the service?*

Your own contributions together with interest allowed by the insurance companies will be paid by them to your designated beneficiary.

32. *What happens to my group annuities if I leave the service prior to retirement?*

If your services are terminated prior to retirement, you will receive from the insurance companies paid-up nonparticipating deferred annuity certificates showing the amount of retirement income purchased for your account to the date of termination.

33. *May I surrender my deferred annuities for cash if I leave the service of the company?*

That part of your deferred annuities which is derived from your own con-

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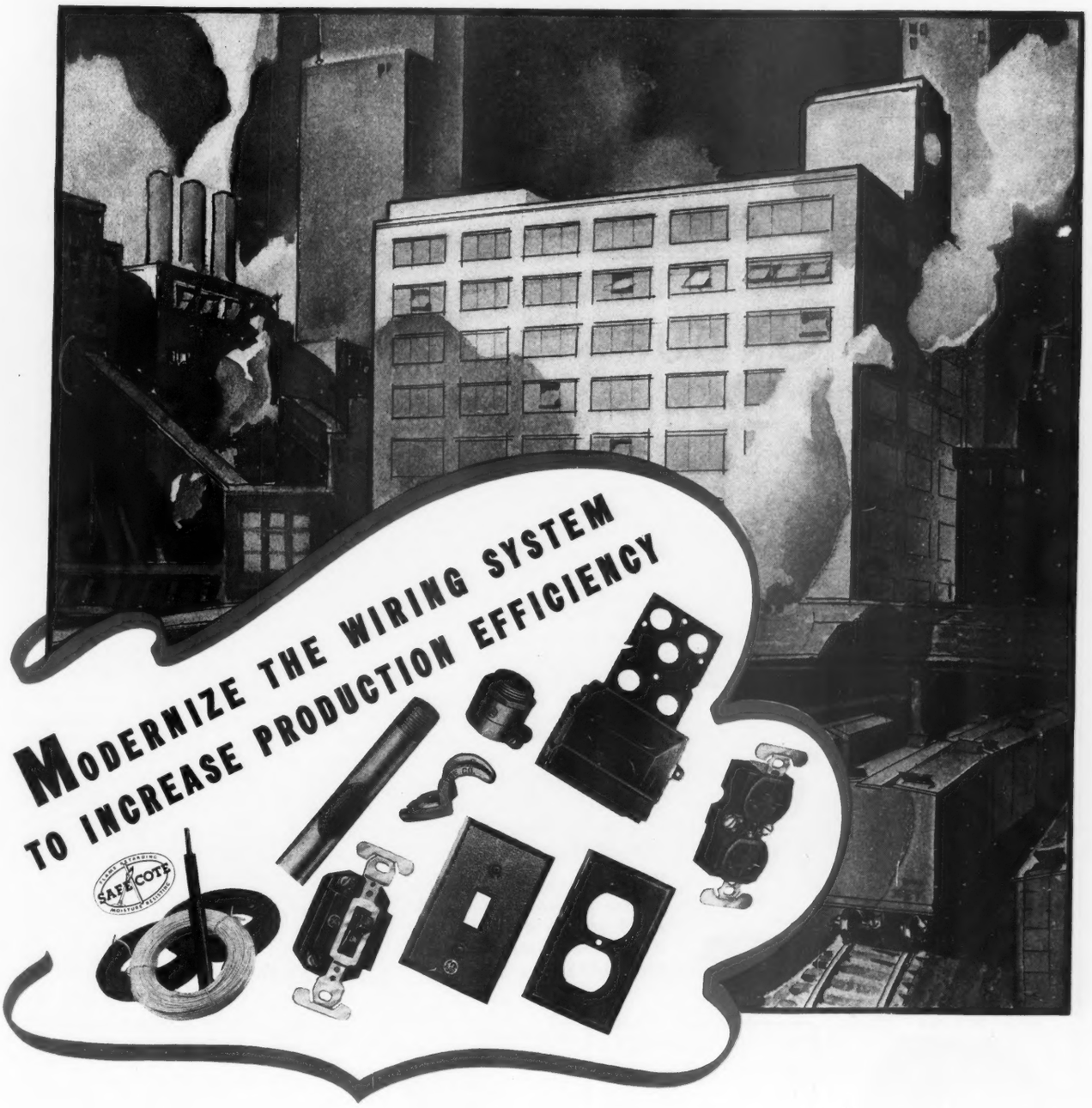

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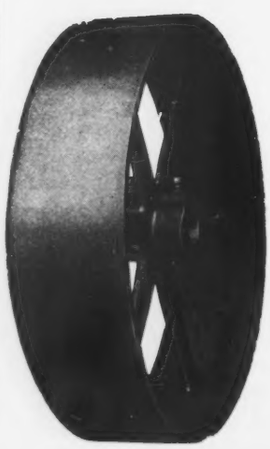

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tributions may be surrendered for cash when you leave the service of the company or at any time thereafter provided annuity payments have not yet commenced.

34. *What happens to my group annuities if I die after leaving the service?*

An amount representing your own contributions and allowed interest will be paid by the insurance companies to your designated beneficiary. No death benefit is paid on that part which is derived from company contributions.

35. *Why is there no death benefit on that part of my group annuities derived from company contributions?*

Because the company's money for group annuities is used to buy a larger retirement income than would be possible were a death benefit provided.

Loans

36. *May I borrow money from the Fund?*

Yes, under conditions which will be determined by the Trustees of the Fund as occasion arises. In addition to your credit balance in the Fund any other suitable security may be accepted as collateral. However, you cannot use your group annuities as collateral.

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Questions and Answers

(Continued from editorial page 88)

fill all cracks with putty or Plastic Wood and paint the beam with a good grade of oil paint, applying a minimum of one prime coat and one finish coat.

On new work only properly seasoned timber should be used, and painting should be done immediately. Care should be taken to avoid alternate wetting and drying of the wood, both before and after erection.

G. L. HOWSE, *Engineer*
The Liquid Carbonic Corporation
Chicago

Why Does Ammeter Needle Oscillate?

I have noticed at different times that when an ammeter is connected in the circuit of an a.c. motor there is a slow, oscillating movement of the needle. The period of oscillation seemed to be about 5 seconds. Some of the motors observed sounded like one with a slightly sprung shaft, although oscillation of the ammeter needle has been observed with new motors having shafts that were apparently perfectly aligned. I wish that some reader would explain the reason for the action. —L.P.H.

POSSIBLE causes for this action are fluctuations in line voltage or frequency, influence of an external magnetic field, and vibration. The extent of any of these influences depends considerably on the type and design of the meter. Some ammeters are designed for quicker damping than others, which, of course, brings the needle more quickly to a steady indication.

(Continued on page 94)

ALL THE LUBRICANTS

used in this Great Plant Last Year*

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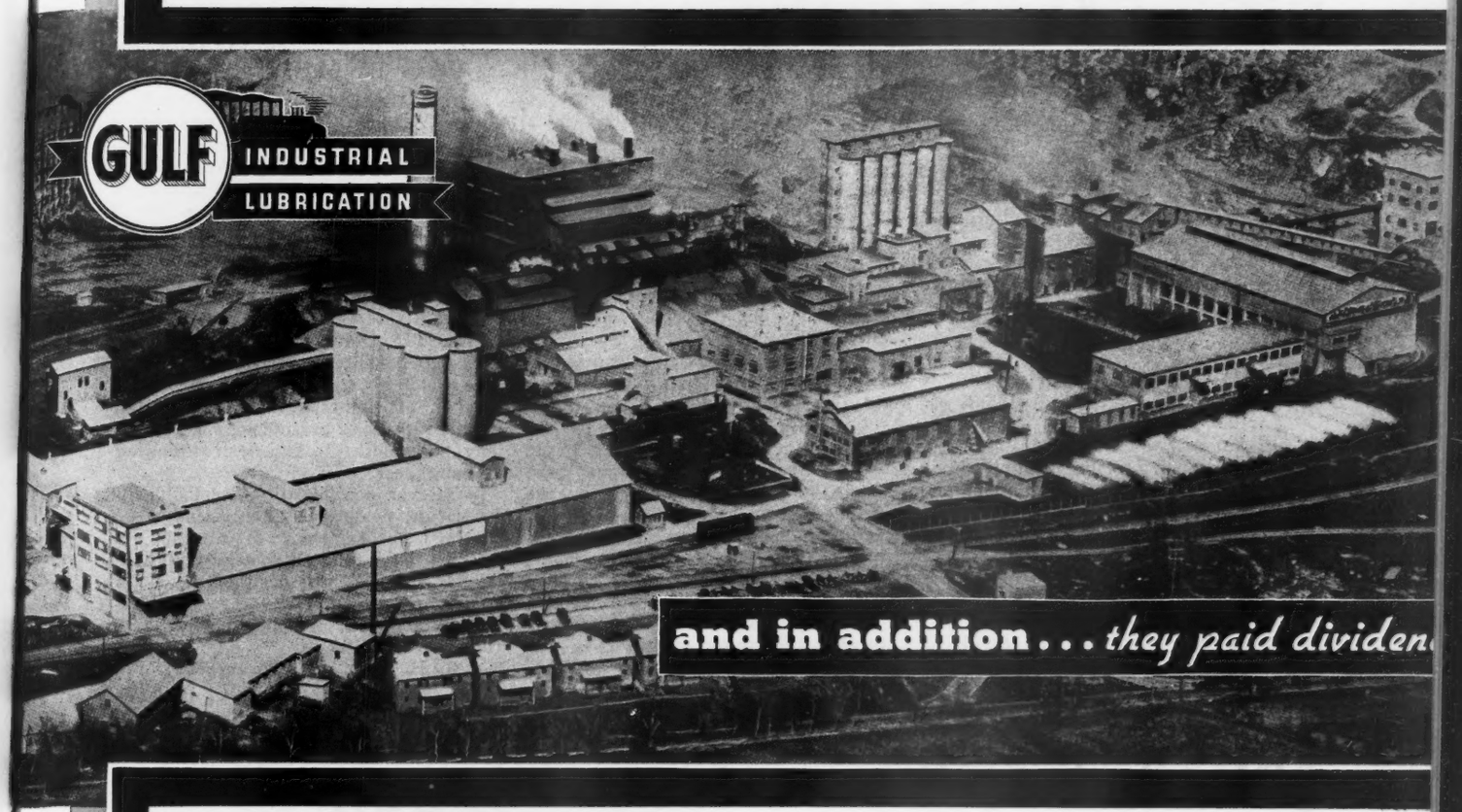

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2 Because of the highly selective treatment given to Gulf high quality lubricants, they have highest resistance to acidity, oxidation and gum-forming tendencies. Hence, they are more resistant to deteriorating influences and are longer lived.

3 When you use Gulf lubricants you receive the service of a trained lubrication engineer. He knows how to make machinery run more efficiently and can be of real assistance to you in solving your lubrication problems.

4 The Gulf engineer aims to reduce your maintenance and operating costs through improved lubrication practice. He strives to make savings in your *real* lubrication costs—as well as to reduce the total gallonage of lubricants consumed in your plant.

Use of Gulf Lubricants and Engineering Service Brought Savings in Maintenance Costs greater than the oil bill

HERE is the statement made by the management of the great plant shown above: "The use of Gulf quality lubricants and engineering service effected four major savings in our operating costs during 1935. They are: (1) reduced power consumption, (2) lower maintenance costs, (3) elimination of waste of lubricants and (4) lower cost for lubricants. *Our savings in maintenance alone have more than paid our lubricants bill!"*

Such records among Gulf users are not uncommon. Invariably, plant officials find that careful attention to lubrication not only reduces the cost for the lubricants themselves but *pays dividends*—in the form of operating economies.

Let a Gulf engineer demonstrate in your plant just how the scientific application of the proper lubricants, selected from Gulf's broad line, can make major savings in *your* operating costs. It is more than likely that lubrication practice in your plant is susceptible to further improvement.

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* *Name of plant and complete report on request.*

Makers of that Good Gulf Gasoline and Gulflube Motor Oil

(Continued from page 68)

There may be another reason for oscillation of the ammeter needle, which is suggested by noisy operation of the motor, similar to that of a motor with a sprung shaft. This is pulsations of the rotor speed, similar to the well-known "hunting" of a synchronous motor. These pulsations are accompanied by a swinging of the stator currents, with consequent wavering of the ammeter needle.

The cause of these slight, periodic changes in speed is usually low voltage at the motor terminals, or improper relation between the number of rotor and stator slots. If the voltage is normal it may be possible to correct the trouble by regrouping and reconnecting the stator coils. In any event, consult the motor manufacturer.

J. L. YOUNG, *St. Marys, Ohio*

Removing Oil From Pipe System

Exhaust from a steam engine was formerly distributed to heating coils in process equipment through a system containing about 300 ft. of piping. No effort was made to remove oil from the steam; so the inside of the pipe has oil on it. Now we want to distribute steam through this piping to a service in which oil is highly objectionable. How can we remove the oil film from this pipe? The possibility of circulatng a caustic soda solution through the pipe has occurred to us, but it would be difficult to do and we doubt whether such a solution would be very effective against the heavy oil. Have any other readers successfully met this problem?

—A.P.W.

REMOVAL of oil from pipe is a bad job, at best. An oil coating may be removed by some alkaline solution, or by an organic solvent. Both of these have drawbacks or difficulties in application. To be effective, alkaline solutions such as caustic soda must circulate at a fairly high rate, and are best used hot. Organic solvents are volatile and expensive; some are highly flammable.

Conditions will largely determine the best method to use. If a suitable tank and circulating pump are available, cleaning with caustic soda may be the most satisfactory. Tank and pump should be installed at the lowest part of the system, which should be opened and the return brought to the tank. If the solution can be heated, vigorous circulation for six to eight hours should be sufficient. When a cold solution must be used, circulation will have to be continued for about 24 hours.

In case an organic solvent is used it may be vaporized or employed in liquid form. The vapor is more effective, and should be admitted to the system at the lowest point. The quantity of solvent needed can be reduced if sections of the piping can be separated and worked on individually.

JOHN P. SIMONS, *Lakewood, Ohio*

Method of Roughening Iron Floor Plates

Sheet-iron floor plates used around certain machines and in places where heavy trucking is done are very slippery when they become oily or wet. I shall appreciate it if readers will tell me the best and cheapest way of keeping these plates rough enough to reduce the chances of someone slipping on them. *—C.S.*

SMOOTH, iron floor plating may be roughened by applying the flame of a welding torch to the surface at a number of points. When the metal becomes fluid to a sufficient depth, it may be puddled to the desired degree of roughness.

Wherever possible, it is advisable to substitute modern, skid-resisting floor plating, rather than to attempt to roughen the smooth plating. These special surfaces are designed to clean easily, drain completely, are comfortable to walk on, and afford good traction for trucking.

S. H. COLEMAN, *Waynesboro, Va.*

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